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Vol. VIII. NEW YORK, AUGUST 14, 1886. No. 7.

OUR illustrated article on the Van Depoele electric railway system gives a good idea of what has already been accomplished in a very short time by one company interested in electric motors and their employment on street-car lines. Mr. Van Depoele deserves great credit for the zeal with which he has applied himself to a solution of the problems involved in the application of electricity in this new and extensive field.

WE give a brief outline this week of the plan of the Beneficial Society instituted by the Brush Company in Philadelphia for the welfare, mental, moral and physical, of its employés. The principle inculcated is that of self-help, and the men are encouraged, moreover, by direct and skilled instruction, to master the details of the work on which they are engaged, and which needs both intelligence and devotion to be entirely successful. The society has our heartiest wishes for its prosperity. Its methods furnish a good precedent.

THE growth of the telephone business is certainly remarkable. In New York City, for instance, as our local letter notes, the subscribers are increasing at the rate of at least 100 per month. As the list now runs over 6,000, it is clear that at such a rate there will be 10,000 subscribers within five years. The expansion of business will develop many new problems for settlement, but it is the evident intention of the officers to be equal to all emergencies. Just now, the pressing matter is that of burying the wires, and from all we can learn, the company is giving its endeavors in the best faith to have the work done thoroughly and as nearly as possible in accordance with the wishes of the Subway Commission.

The method of supplying a regulator, in the shape of a storage battery, for unsteady engines driving lighting dynamos is one that commends itself, not only on account of the perfection with which it accomplishes its primary object, but also on account of another not less important consideration, and that is the power of the battery to provide sufficient current to bridge over a temporary stoppage of the engine in case of accident. M. Reynier, however, who has already done some notable work in the field of the storage battery, argues that, since accidents which would cause a delay of more than half an hour at critical times are rare, a large store of electrical energy is not necessary to meet the emergency, and that a means of securing steadiness of the light, together with a small storing capacity, is sufficient for all practical purposes. M. Reynier believes such a combination to be presented in the voltameter of his design; and the idea must be admitted to be quite novel and ingenious. Several advantages are cited, among others the higher E. M. F. attainable by the use of voltameters as compared with the ordinary lead storage battery.

IN the concluding portion of his remarkable paper on the self induction of an electric current, Prof. Hughes gives a summary of the results he has obtained. They are worthy of the most attentive study of all engaged in practical electrical work. We cannot pass over the facts brought out in the concluding portion of Prof. Hughes' paper without commenting upon their direct bearing in practice. Thus it is shown that, while, as is well-known, a solid iron core within a helix, magnetizes and demagnetizes slower than one built up of iron wires, probably this effect is primarily due to *eddy currents* set up in the solid iron core, which prevent the rapid change in the magnetic state. By the suppression of the eddy currents through substitution of an iron wire core, the rapidity of action caused an increase of more than 100 per cent. in the strength of the extra current. By still further preventing the formation of these deleterious currents by insulating the wires composing the core, a yet more beneficial effect was obtained. This direct experimental proof is in full accord with the best practice in dynamo construction, where the suppression of the Foucault currents has come to be looked upon as of the first importance.

WE understand from General C. P. Stone, who has charge of the Bartholdi statue and work thereon, that he has got to the point at which thought must be given to the installation of an electric plant that shall efficiently light the statue. According to General Stone's estimate, about 50,000 actual candle-power will be required to illuminate the gigantic Goddess of Liberty adequately, and the work is now at such a stage as to require an early settlement of the lighting problem. Congress has seconded the effort made by the public of getting funds for the erection of the statue, and has appropriated enough for the satisfactory completion of the work. It will be remembered that we opened our columns last year to a discussion of the best manner of lighting the statue. Several interesting opinions were elicited. The plan at present in favor is to light the "flame," to place a light with reflector so as to bring out the face, and then to place lights at the feet, reflecting upward. Thus the sky above the statue, the face and the figure will all be lighted up, presenting a beautiful appearance. Those who contributed to the erection of the statue will soon have the pleasure of seeing its torch of electric light gleaming nightly across the waters of the Bay.

ACTIVITY in one department of applied electricity is always sure to lead to developments in kindred branches. In substantiation of this we need only refer to the impetus which minor electric lighting has given to the improvement of the primary battery, and our columns frequently contain notices of inventions and changes in this direction. The open-circuit battery, intended for light intermittent work, however, while not neglected, has undergone no decided change within recent years, so that a new departure here will excite interest. Mr. I. L. Roberts' new "dry battery," described in another column, is a decidedly ingenious application, and it may be characterized as the first dry battery adapted to practical commercial work. In many situations where the liquid cell is an annoyance, the present form will commend itself as eminently desirable. Mr. Roberts has conceived the ingenious idea of making the carbon electrode the outer inclosing vessel of his cell, and in this manner he reduces the space occupied. Another interesting property is its power of attracting moisture from the atmosphere by the deliquescent salts contained within; this additional property of the battery, viz., that of attracting moisture, gives it an increased value for some purposes where it is desirable to maintain apparatus dry and still have the source of electricity close at hand.

THE ease with which the electric light can be switched on and off is an important factor in its function of a street illuminant, and deserves attention on account of the economy which it permits of. As Mr. Howells points out on another page, it is a great waste for hundreds of lamps to be burning while the streets are amply lighted from the natural source. He lays particular stress upon the growing popularity of the electric light, and instances the fact that by the use of the latter, when a city is depending upon a half-moon for light, and clouds should come up to obscure its beams, a turn of the hand would bring the public lamps into use. In large and wealthy cities it is the practice to burn the electric lamps all night throughout the entire year, but in smaller and more economical towns a suitable time-table for the lighting and extinction of public lamps is of value, especially with electric lighting, where the expenses for coal and carbons are in direct proportion to the time of burning lamps. One to two hundred hours saved out of a total of about 2,000 hours of lighting per annum may lead to increased profits without causing complaint. We know of cases in which, before the introduction of the electric light, "full moon" in the calendar meant no gas in the streets whether it poured in torrents of rain or not. Since the advent of the arc lamp in those streets, however, that time is happily past, never to return.

THE Edinburgh *Scotsman* makes a recent number of THE ELECTRICAL WORLD the theme for an article nearly a column and a half long. The article doing us so distinguished an honor in the leading Scottish daily has a little dig at the "spread-eagle oratory" of the railway telegraph superintendents, whose meeting at St. Paul we reported, and betrays some amusement at our account of the fireworks, balloon ascent and parade with which the installation of an Edison plant at Laramie was signalized; but, taken altogether, it is very appreciative of "characteristic energy and courage" displayed by American electricians. The good citizens of Edinburgh are told that "the Americans are a go-ahead people, and in mastering the secrets and applying the powers of electricity they have outstripped the rest of the world." Further, "only a little inquiry is needed to fill any inhabitant of this country with wonder and admiration, perhaps not unmixed with envy, at the gigantic strides made in spreading the electric light in America." The *Scotsman* then quotes some instances from our columns, and adds: "These cases, culled from many, may serve as illustrations both of how the use of the electric light is spreading in America and with what feelings the people of every locality welcome the new luminary." The kindly feeling evinced throughout the article toward American progress in electricity becomes the countrymen of Michael Faraday and William Thomson.

AFTER some delay and mishap, to be expected in connection with all new enterprises, a commission of French scientists, appointed for the purpose, have certified that M. Deprez has successfully accomplished the continuous and regular transmission of 52 horse-power over a distance of 35 miles without exceeding a current of 10 amperes, and at an efficiency of 45 per cent. The report of the commission states that the high E. M. F. of 6,290 volts employed does not give rise to any danger, and that no accident has occurred during the past six months. We are glad to note that M. Deprez has succeeded in accomplishing what he set out to do. But coming back to the question of economy, which we have borne in mind from the beginning, we find that, according to the commission's own statement, it would cost in the neighborhood of $25,000 for plant to transmit 50 horse-power over 70 miles of line, as in the present instance. The commission adds, however, that with the manufacture of the machines regularly undertaken, the cost could be considerably reduced. Taking the report as the expression of unbiased opinion, it shows that at present long-distance transmission of power can be accomplished electrically, but only at the sacrifice of economy. We hope M. Deprez will continue in this work and finally arrive at a system which will combine in itself all the requirements of actual practice. In contradistinction to the trouble experienced in long-distance transmission, the successful application of the electric motor within a limited distance from the generator is now an established fact, to which our columns bear witness each week.

Researches Upon the Self-Induction of an Electric Current.

BY PROF. D. E. HUGHES, F.R.S.

(*Concluded.*)

INFLUENCE OF COPPER AND IRON CORES UPON THE INDUCTION AND RESISTANCE OF COILS.

It is well known that a coil of wire has a higher self-induction than the same wire in a single loop, and that the coil has a still higher induction when we introduce an iron core. I have made, however, a series of experiments in order to measure the influence of a core upon the resistance in the variable period, and also note the influence exerted by the induced or eddy currents circulating in the core.

Table IV. shows some comparative results.

A helix was formed of an insulated silk-covered copper wire of 24 single layers, having an interior diameter of 2 cm., the object being to form a coil having as little mutual induction as possible, but which would be readily acted upon by any core of metal introduced; and in order to measure the high forces obtained an induction balance of great power and range was used, the method, however, being the same as that already described.

The helix alone showed an induction value for its extra currents of 460, and a feeble increased resistance in the variable period of but 10 per cent.; if we now introduce a core of solid copper of 1.75 cm. diameter and 5 cm. long, a great change takes place both in the force of the extra currents and the resistance in the variable period; the extra currents fall in value from 460 to 352, while the extra resistance is increased to 52 per cent. above that of the stable period. We have here a double and contrary effect; the reduction of the force of the extra currents and the increase in the resistance cannot be due to the magnetic nature of copper, but must be due to the induced or so-called "Foucault currents" circulating in the core. To prove this the core was replaced by another similar in every respect, but cut longitudinally to its centre: the currents now ceased to circulate, and the copper core had not the slightest effect either on the extra currents or the variable resistance.

This is shown in the table, where for greater precaution a core of insulated copper wires replaced the solid core. Evidently the induced current in the core was the cause of the extra resistance; work was done by the primary current, and a loss of energy at the expense of the electromotive force of the extra currents, but in doing this work a resistance was produced which was no doubt caused by the currents circulating in the core. These currents required time, passing through the variable stage and thus producing from their electro-magnetic inertia an equivalent reaction and electro-magnetic inertia in the primary coil itself. That this inertia is due to the electro-magnetic character of the current and not to an electric current considered apart, is proved by the fact (which I have verified that when we coil a wire into a coil of several superposed layers, its electro-magnetic reactions introduce a measurable resistance in the variable period precisely similar, though feebler, than that which would be produced by the reaction on the conductor of a magnetic body such as iron.

TABLE IV.

Helix formed of insulated copper wire, 1.50 metre in length, 2 cm. diameter, and 24 turns.	Comparative force of the extra currents.	Resistance in ohms, stable period.	Resistance in ohms, variable period.	Percentage of increased resistance in variable per d.	Absolute increase of resistance in ohms.
Helix alone	460	0.02632	0.02896	10	0.00264
Same with a core of solid copper	352	0.02632	0.04013	52	0.01381
Same with a core of insulated copper wire	460	0.02632	0.02896	10	0.00264
Same with a core of solid soft iron	2,398	0.02632	0.09870	275	0.07238
Same with a core of 445 separate fine iron wires, each 0.25 mm. diameter	5,360	0.02632	0.04448	69	0.01816
Same with a core of silk-covered fine insulated iron wires	5,820	0.02632	0.04075	55	0.01443

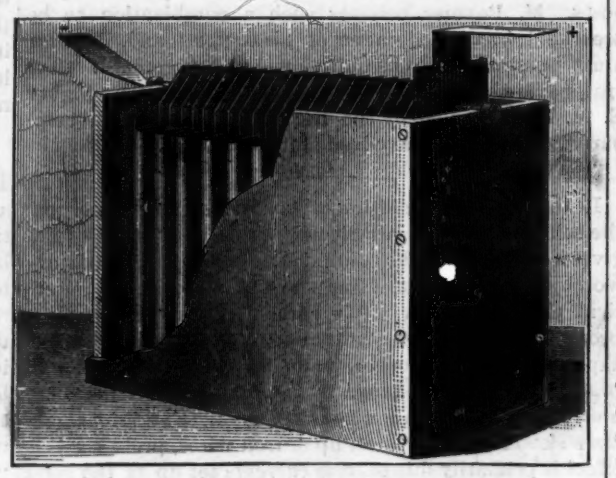
The effect of a solid iron core and a bundle of iron wires on the increase of the force of the extra currents is well known, but the table shows an interesting result as to their effects on the variable resistance; the solid iron core shows a very high force of extra currents produced by its magnetic reaction on the wires of the helix, the resistance in the variable period has increased 275 per cent., and its extra currents are extremely high, as we should expect. Now, if the extra resistance is due to magnetic reaction alone, it should increase when we are enabled to increase this reaction, but if it is due in greater part to the electro-magnetic inertia of electric currents circulating in the bar, then by preventing these currents from being formed (as we did in the case of copper), we should greatly reduce the extra resistance. This proved to be the case, for on replacing the solid iron core by a bundle of fine iron wires the force of the extra currents rose from 2,338 to 5,360, or more than double the force of that produced by a solid bar, while the resistance in the variable period fell from 275 to but 69 per cent.

It is well known that a bundle of fine wires magnetizes quicker than a solid bar, and this may have had its effect, although not more important than the suppression of the eddy currents, as the latter may be the cause of the former. The table shows that where we have suppressed these currents as far as possible by introducing a core of insulated wires containing less iron than in the previous experiment, but fully insured against eddy currents, the induction was the highest and the resistance the lowest yet found for a helix containing an iron core. The experiment proves to my mind that the extra resistance found in the three last experiments is due both to the electro-magnetic inertia of the eddy currents, and the inertia of the magnetic molecules of iron.

The experiments related in this paper have been most carefully made and verified, and from the ease and certain action as well as the invariable results obtained by the method which I have described, they should be easy to repeat by others.

If we regard the whole of these researches we cannot fail to notice certain important laws which act in the greater portion of them. I have shown: 1st. That the contiguous portions of the same current react upon each other in the interior of its own portion of the conductor similar to their known exterior reactions on separate portions of the same conductor. 2d. That the co-efficient of mutual induction is less in iron than copper wires, but that their co-efficient is the same when the conductor is in the form of a ribbon. 3d. That the inductive capacity of different metals depends on their specific resistance, on their electro-magnetic capacity for circular magnetism, and on the geometrical form of their conductors. 4th. That the inductive capacity of a conductor of magnetic metal is dependent upon the formation of circular magnetism and not upon its internal magnetic permeability. 5th. That a magnetic metal can be rendered equally free from circular magnetism as the non-magnetic metals. 6th. That we have experimental evidence of electro-magnetic inertia and the deleterious effects of eddy currents in the cores of electro-magnets.

In addition to the above effects, we have the discovery



REYNIER'S VOLTAMETER.

of a large increase in the ohmic resistance during the variable period, allowing us to demonstrate and measure the gradual rise of an electric current in its conductor.

CORRECTION.—Our attention has been drawn to an error which occurred in Table III. (p. 55, July 31) of Prof. Hughes' paper, "Researches upon the Self-Induction of an Electric Current." The diameter of the iron gas-tube given in the table as 10 c.m. should evidently read 10 m.m.

Voltameter for Equalizing the Effects of Unsteady Engines.

Electric lighting, especially that by incandescence, depends much for its success upon the regularity of the engine, for so sensitive is the incandescent lamp to a variation of current that the change in speed caused by the lacing at the joints of the engine belt sometimes causes a flicker in the lamp. It has frequently happened that electric lighting plants have been installed in places where the engine was not of a character to give satisfaction regarding steadiness of light, and it then became necessary to add a "regulator," in the shape of a storage battery. The latter, as is well known, no matter how irregularly it may be charged, gives out its current in a perfectly regular manner, so that by interposing the storage battery in the lighting circuit the current entering the lamps is perfectly steady.

Writing on this subject in *La Nature*, M. E. Reynier remarks that since storage batteries are here employed only as regulators, they may be economically replaced by voltameters.

The regulating power of a secondary battery does not depend upon its electro-chemical *capacity*, but upon its efficiency of conversion; in other words, a series of voltameters slightly, or not at all, "formed" will act as regulators, equally well as and perhaps better than a battery of accumulators of the same E. M. F. and resistance.

The question of capacity being eliminated, the construction of secondary couples is much simplified. At the same time the choice of combinations is widened. In addition to Planté's couple, which has thus far been principally employed in the accumulator, other systems may be tried.

The zinc-lead couple, for example, presents important advantages, when a prolonged storage of the charge is not required. Its high E. M. F., 2.4 volts, as compared with that of Planté, 1.9 volts, allows of a reduction in the number of cells as well as of the resistance of the battery; its variations are even less than those of lead-lead couples; and finally, in cases where a certain capacity would be necessary, so as to maintain a current during 15 or 30 minutes, it can be formed from the start.

The zinc lead system has therefore been chosen by M. Reynier, and the ordinary cell is shown in the accompanying illustration.

The positive is a long strip of lead folded, as shown, and exposing a surface of about 150 square decimetres. The negative consists of 21 strips of lead inserted in the folds of the positive, and suspended by a copper collector covered with lead, which rests on the ends of the containing vessel. The liquid employed consists of water acidulated with sulphuric acid and one-half saturated with oxide of zinc.

The voltameters, like the accumulators, are placed in a derived circuit or shunt to the main current, thus receiving a small fraction of the current which maintains them charged.

In order to give these voltameters a certain storage capacity it suffices to subject the positive plates to the nitric acid treatment of M. Planté. They thus acquire the property of fixing a considerable quantity of oxygen. As for the negative plates, they are formed immediately by an electrolytic deposit of zinc. A battery of voltameters, with the positive plates prepared as above, is capable of maintaining illumination for half an hour, a sufficient length of time, in most cases, to repair any ordinary accident or to prevent an impending one.

The model illustrated is capable of regulating a current of 100 ampères. Its E. M. F. is about 2.4 volts, and it only requires 44 of them to regulate the light of 200 incandescent lamps requiring ½ ampère at a potential of 100 volts. For the same service 55 double-lead storage-batteries would be required. An economy of 70 per cent. is thus obtained.

Underground Cables and High Tension Currents.

At Nigmegen, recently, there has been completed an arc light installation consisting of ten lamps, fed by underground lead-covered cable, 4,000 metres in length. The cable is protected outwardly by a kind of braiding, while the core (12 strands No. 16) is insulated by several layers of India rubber. The wire is laid in the streets at a depth of 2 feet, without having any other outward protection. The strength of the current is 18 ampères, with an E. M. F. of from 500 to 600 volts. It would of course be premature to pronounce any decided opinion as to the ultimate results of the use of a cable in this way, says the London *Electrician*, but up to the present it has been satisfactory—a state of things which, being so intimately bound up with the future success of the electric light, it is to be hoped will continue.

An Incandescent Lighting Schedule.

Subjoined is the scale of rates adopted for the Edison plant at Middletown, Md.:

HOUSE RATES.

1 10-candle power light, per month	$0.60
2 10-candle " "	1.00
3 10-candle " "	1.40
4 10-candle " "	1.70
5 10-candle " "	2.00
Each additional 10-candle light	.15

SCHEDULE OF RATES FOR COMMERCIAL PURPOSES.

Burnt till 10 p. m.

10-candle power, each light per month	$0.80
16-candle " " "	1.20
24-candle " " "	1.70
32-candle " " "	2.35

Burnt till Midnight.

10-candle power, each light per month	1.05
16-candle " " "	1.50
24-candle " " "	2.15
32-candle " " "	2.80

Burnt All Night.

10-candle power, each light per month	1.35
16-candle " " "	1.85
24-candle " " "	2.60
32-candle " " "	3.60

RULES AND REGULATIONS.

Lamps supplied to consumers by the company. Lamps carelessly or accidentally broken paid for by the consumer. Plain wiring for lamps, everything properly connected, upon present gas fixtures or independent, free of charge. Any extra fixtures, shades, holders, and switches, to be paid for by the consumer.

The company reserves the right at any time to discontinue current to prevent fraud or abuse. The company shall have the right to enter any house for the purpose of examining or removing any lamps, wires, or fixtures at a seasonable hour of day. Five per cent. added if not paid within five days.

Presidential Economy.—The President's war on telephones in public use has begun in earnest, and nine out of nineteen heretofore in use by the War Department in Washington have been removed, and nine out of eighteen used in the Navy Department. This "reform" will extend farther, and an investigation is now going on to ascertain the extent of the need for telephones at each navy yard and at army posts and headquarters. The officials at each public building in the United States will also be required to reduce the number of instruments in use, the general ratio of reduction probably to be one-half, as at the executive departments at Washington.

Electric Lighting in Guatemala.

BY B. T. BURT.

Probably few of your readers are aware that at Guatemala electricity is called into use quite as extensively as in some of the more enterprising cities of the States.

Guatemala is said to be the Paris of Central America. It is a city of sixty thousand inhabitants, situated nearly 5,000 feet above the sea, and inland about seventy-five miles from the Pacific, with a climate not to be equaled anywhere. The city stands upon a plain and is laid out into squares by the intersection of twelve long avenues with eighteen streets, paved with white cobble-stones.

There are several suburbs to the city which help to make up its size. Among its many public buildings it can boast of a fine national theatre, several large and commodious hotels, two elegant clubs, two fine banks, a general post-office, with a system of delivery and street letter boxes. There is a good police system, similar in every respect to that of New York, with four precincts or sections. The city is crossed and the suburbs are reached by several lines of street cars, which centre at the large "plaza de armes."

Here the great cathedral faces the "Palacio Nacional" upon the opposite side, a custom which seems to have been universal in, as it is characteristic of, all these Spanish built cities. It is difficult to tell exactly in which building lies the real seat of government. The city can boast its technical school, school of arts, law school and public library. It may even glory in its twenty-seven drug stores.

Now, with this little description of the place, one can form an idea of what it would need in the way of electricity.

We have the electric light, the telephone and the telegraph. The "Compañia Alumbrado Electro de Guatemala," of which Señor Don Julio Novella is president and general manager, was formed in December, 1884, and having procured a valuable concession from the government, for the exclusive privilege of electric lighting in Guatemala, it sent its agent to the States to select a desirable system from among the many, each of which was "the best and only perfect system in use." However, the purchasing agent came off all right, and the company now has a fine station situated four miles from the city and 800 feet below in a large cañon or "barranco."

It is equipped with six Thomson-Houston 50-light dynamos driven from two shafts by a 30½-inch Leffel turbine each.

The dam is the finest piece of solid mason-work in Central America, being 80 ft. long, 40 ft. wide at the foundation, and 40 feet high, carrying a head of 37 ft.—but, unfortunately, by carelessness in measuring the flow of water at the outset, and also being just at the close of a rainy season, when the supply was greatest, the quantity for the dry season was estimated incorrectly, and to its sorrow the company finds itself short of power to run the full three hundred lights, as it intended; but nothing daunted, it has commenced work with a view to moving further down stream, and carrying the water in iron tubes, until a fall of over 100 ft. is obtained, giving a surplus of power, which the company intends to utilize in driving two additional arc light machines and some for incandescent lighting with distributing boxes.

There are five circuits, each averaging twelve miles in length, and the wire is neither upon poles nor underground, but under the eaves of the one-story houses, an advantage in one way, as the insulators are kept dry in rainy weather.

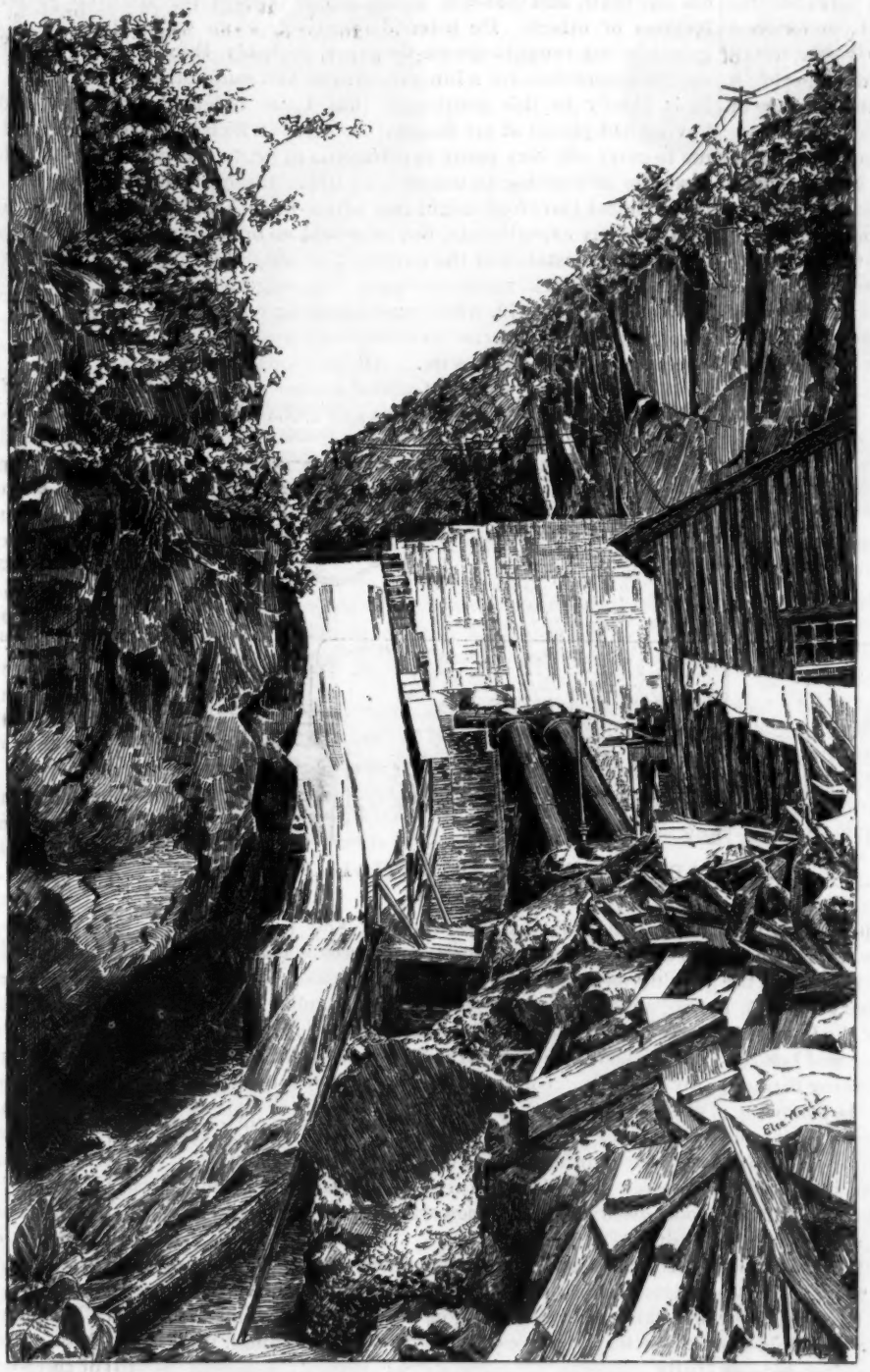
The lamps are suspended from iron brackets upon posts at the street corners, and are arranged to slide in to clean and recarbon. The lights are of 1,000 c. p. and burn twelve hours. The large plaza is lighted by a cluster of four in the centre and one in each corner. The largest customers for private lights are the "Club Guatematteco," which has eight; President Barrillas, four; and the National Theatre, ten. The price per light per month is $15 till one o'clock and $25 all night.

The stores in this country do not keep open at night; everything is barred, and the city is patroled by military guards as well as numerous police. On passing by any of the numerous "cuarteles" or barracks, one is challenged, and if it is his first experience the effect is quite electric. His hair is apt to stand on end when he is startled by the quick, sharp cry of "quien vive!" by the sentinel. One drug store has an isolated plant of 20 8 c. p. Edison lamps run by a Freeman dynamo.

Guatemala has a telephone exchange of two hundred subscribers. The company hails from San Francisco. The switch boards are of the Western Electric Company's make, as well as the Gilliland magnetos and regular Bell telephones. The rental per month is $5. The telephone takes well here, as the people like anything that will save trouble or work, or will help to put a thing off "hasta mañana."

The telegraph is a fine institution, owned and operated by the government. The republic is crossed by a net work of wires connecting the interior towns with the capital and the coast. The cable landing is at La Libertad in San Salvador, and is connected by telegraph with this city. In time of trouble between the two republics, Salvador has the advantage, for she can control and cut off Guatemala's cable communication with the outside world. The general office is one which Guatemala may well be proud of, being fitted up in luxurious style as regards comfort, appearance and facility of dispatch. The late president, General Barrios, did for the telegraph what he did for everything else in Guatemala. It owes its general arrangement and equipment to the good judgment and able management of Mr. S. McNeider, its first superintendent, from New York.

Lately some French novelties have been imported in the way of electric cigar lighters, small lamps for batteries, scarf-pins, etc.



WATER POWER OF ELECTRIC LIGHT STATION, GUATEMALA, CENTRAL AMERICA.

"Electricity in Guatemala" would be incomplete if I should omit to say anything about the high strung and the very erratic form which visits us as lightning. During the rainy season it is simply terrific. In the afternoon clouds can be seen forming in great vapory masses, over the hills and cañons east of the city, then gradually changing and settling down to the form of the dark nimbus. Then when all is ready, the mass advances upon the city and pours forth torrents of rain with continuous and blinding flashes of lightning, and peals of thunder loud and sharp enough to wake the dead in the old Indian mounds so common in the country. The telephones keep up an incessant ringing and snapping from the induction. Generally a piece of gas or water pipe extended above the houses serves as lightning rod, although it does not exactly agree with Prof. Hughes' latest experiments.

Heating Foot-Warmers by Electricity.

M. Tomasi, says the *Proceedings Institute Civil Engineers*, has introduced an improvement in the plan for heating foot-warmers for railway carriages with acetate of soda, by causing a current of electricity to pass through the liquid solution in such a way as to produce an increase of temperature, and so maintain the heat lost by radiation. The current generated by a dynamo, driven from one of the axles of a luggage-van, is sent through a circuit which extends from one end of the train to the other, and from this main circuit the branch conductors that pass through each foot-warmer in a longitudinal direction are connected. The foot-warmers, which are previously filled with acetate of soda, hyposulphite of soda, or some other salt of soda, having the property of maintaining a large amount of latent heat, which is disengaged when passing from a liquid into a crystalline state, are before starting plunged into boiling water, and when sufficiently heated, placed in the carriages, and connected with the circuit. When the train is stopping, no effect is produced, but as soon as a sufficient speed is attained, the electric current, generated by the dynamo, traverses each foot-warmer, and the conductor in it being of less section than the one outside, a greater amount of resistance is offered to the passage of the current, and in consequence heat is produced, and is communicated to the solution, replacing that which has been lost by radiation in warming the vehicle. The quantity of latent heat in the solution being considerable, a stoppage of even three hours is not capable of producing such a cooling effect as to render necessary its being reheated by other means beyond that described. A simple arrangement by which the conductor in the foot-warmer is thrown out of circuit when too hot, prevents any danger from overheating.

English Telegraph Reform.

At a meeting of the Congress of the Chambers of Commerce of the British Empire, recently held at the Indian and Colonial Exhibition, Sir James Anderson read a paper in which he proposed a reduction of telegraphic rates, the extension of telegraphs, the Government supervision of telegraphs, and the neutralization of cables in time of war; these being the subjects with which the Congress had primarily to deal. The reduction of tariffs, according to the plans put forward by the speaker, involved state aid; but the gain would be in commercial activity being stimulated. The system of coding messages was next referred to as unfair; words unknown to any language being telegraphed. It permits a person to send ten words for one. Objection was not made to the use of the eight authorized languages, but to made-up words, which, Sir James Anderson thought, would in time drive the companies to protect themselves against the system by a high single letter tariff or a fixed code. With regard to the neutralization of cables, Sir James Anderson thought that the laying of alternate cables for times of war was not a good plan. If an existing line is cut, chartered vessels or gun-boats can bridge over the cut section; and there was no doubt, in his opinion, that ships with telegraph cables would always follow the fleet, with the object of connecting any points telegraphically which are best calculated to insure uninterrupted communication with the base of operations or headquarters. These new-laid lines would have the advantage of their route being unknown to the enemy, and therefore not so easily interfered with as alternative routes already provided, and therefore known to the enemy. Cutting cables in time of war did not appear to him so important as it looks at first sight.

Direction of Current.

To the Editor of The Electrical World:

SIR: Will you please inform me through your columns what is the true course in which the current of an open-circuit battery flows within itself? Does it flow from the zinc to the carbon, or the reverse? I see that some authorities differ. S. W. E.

HARRISBURG, Pa.

ANSWER.—We can hardly believe that "authorities" differ on this point. It is generally accepted that within the battery the current flows from the zinc to the carbon, and in the reverse sense in the external circuit.—EDS. E. W.

A Franklin Statue.—A fine statue in marble of Benjamin Franklin was sculptured by Canova on an order from the United States, and was on its way there, in 1810, when it was captured by pirates from North Africa, and sold by auction at Algiers to the Swedish Consul-General, F. Skoldebrand. This gentleman presented it to the Prime Minister of Sweden, the Right Honorable Baron E. M. Rosenbad, whose nephew is now having it exhibited in Paris.—*Philadelphia Telegraph.*

The Working of Uninsulated Lines by Means of Potential Plates and Military Telegraphs.

BY W. E. IRISH.

(Continued.)

The secret message cipher-wheels or clyptographs are useful with the Morse code; they are about the size of and somewhat resemble a watch in appearance, having two hands or pointers. To the larger pointer is fitted a milled thumbscrew, by which means the pointer can be directed to the letter desired to be sent or deciphered. At the same time, and by the same means, the small hand is caused to point to the cipher letter in one instance and the correct letter in the other. The hands do not work synchronously, but one will gain or lose a different number of letters each revolution. The key to the cipher is the number of letters differing between the two pointers at starting, and can be altered both in difference of number and the direction in which to turn the hands. For instance, it may be pre-arranged to start with the small pointer six letters in advance of the other for the first ten letters, eight for the following ten letters, and twelve points in advance for the remainder of the message. It can readily be understood that should the cipher message with the clyptograph fall into the enemy's hands, the time occupied in deciphering it without the key would most likely deprive the message of its otherwise valuable character.

I notice that Captain Cardew, in his able paper before referred to, recommends the telephone as an instrument to be employed for military telegraph purposes. Of course, there is nothing new in this idea, as the employment of the telephone in the field was one of the first things to suggest itself to every one when the invention of the telephone was only whispered about. What is new is the apparatus designed and the system employed by him.

The fact that an uninsulated wire can be employed for telegraph purposes is not generally known, and to many, no doubt, is incredible; but to the fact that it is possible I can testify, having repeatedly proved the possibility myself as far back as ten or eleven years ago, when messages were transmitted through an uninsulated wire laid on the wet ground and through a canal. On February 13, 1875, I gave Colonel, then Major, A. G. Durnford, of the Royal Engineers, and Captain Cardew's brother officer and late colleague, a paper on the subject, entitled "Working through an Uninsulated Wire," from which I extract the following:

"If, therefore, we construct a line of a conductor, the electricity of which is neutral or in equilibrium, *i. e.*, being the mean of the potential between two other conductors, we can, by simply attaching a plate of one polarity to the line, upset this equilibrium in one direction, and by substituting the second plate for the first, the balance will be upset in the direction reverse to the first. * * * Before going further, it should be understood that our first desire is to obtain a line wire and earth of a metal which shall be precisely neutral to the two opposing battery plates used for signaling. This it is proposed to do by making the line-wire and earth of a metallic alloy, the potential of which shall be in exact proportion to the potential of the plates employed for signaling, one of which will be of the highest obtainable potential, and the other of the lowest. So long as the line with its earths remains at the same potential, no disturbance or electrical distribution takes place; but immediately on making contact with the system with a metal either positive or negative to it, electricity will be produced of sufficient electromotive force to work the special apparatus hereafter to be described. * * *

"Let us imagine such an arrangement, and assume that no electricity at present exists on the line. Now, if we suddenly disconnect at one end of the line the neutral ground plate and substitute another of different potential, we will cause an electrical disturbance throughout the system. * * * By again disconnecting the latter and connecting the neutral ground plate as before, the equilibrium of the system is immediately re-established and the instrument in circuit obeying, returns to its position of rest. If we now take a plate having a different potential to either of the above, and again substitute it for the neutral ground plate, we shall cause an opposite signal or deflection in the recurring apparatus at the distant end to that previously given. * * *

"An electrical disturbance will occur on any metal not of exactly the same potential as the line making contact with any portion of the system, and the needle of a galvanometer in circuit will be deflected right or left, according to the polarity or potential of such metal. It is, therefore, advisable to protect, to a certain extent, such line by a covering only sufficient to protect it from making metallic contact."

All my experiments were made with copper and iron systems, the only wires at my disposal. A better result would, no doubt, be obtained with a wire specially made and plates having greater difference of potential than zinc and copper. From a note dated January 21, 1875, is extracted the following sketch, Fig. 1, and accompanying remarks:

"A system of telegraphing through an uninsulated or insulated line, with or without the aid of voltaic batteries."

The principle is the same, whether employing chemical batteries or potential plates. The line system should be neutral between the two sources of power employed for signaling. When voltaic batteries are employed, a better insulation is needed.

Colonel Durnford, a perfect gentleman and soldier, had but one fault, and that was a too tender regard for the feelings of others. He listened attentively to me when I gave him my roughly-drawn-up paper, probably thinking me a fair candidate for a lunatic asylum, and said nothing. It is chiefly to this gentleman that I am indebted for having had placed at my disposal the means which enabled me to carry out very many experiments to prove the practicability of working an uninsulated line. It is quite likely that Colonel Durnford might not often have known the results of my experiments, but he would no doubt remember the circumstance of the paper. The possibility of being able to work an uninsulated line suggested itself to me some time in 1872, when experimenting with a view to employing earth batteries for military telegraphs. I wished to employ an iron line wire. All previous experiments having been made with a stranded copper core cable, the only iron wire at my disposal was a half cwt. of No. 16 B. W. G., galvanized; this was uncoiled and temporarily hung up on sheds, fences, hedges and trees. The experiments having been completed under the above position of the line, which was practically insulated, and wishing to know the effect of earth on the line, I removed some of the wire off the hedge and placed it in the water of the ditch running beside. On resuming my experiments, I was surprised to find that it made scarcely any perceptible difference from the experiments previously carried out, and therefore I inferred that by some means the fault had been removed by pulling the wire out of the ditch; but it was soon discovered that such was not the case, and that the fault was as I had left it.

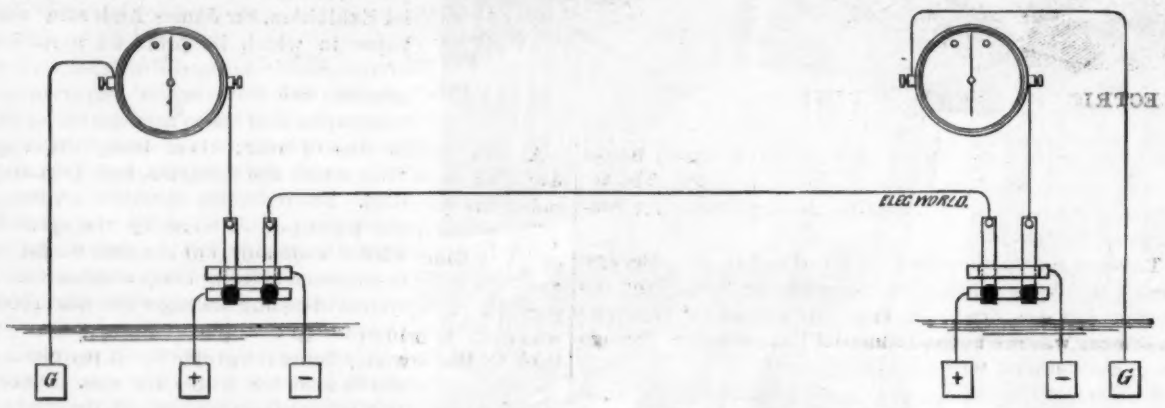


FIG. 1.—IRISH'S METHOD OF TELEGRAPHING WITH POTENTIAL PLATES.

After repeating my experiments to satisfy myself on this point, I removed the whole of the wire from the fences, etc., and laid it about on the wet bog and sandy soil, and after various experiments worked through it successfully.

From a note dated Sept. 27, 1875, are extracted the following remarks and sketch:

"Arrangement thus: All signals clear and distinct. Line consisted of half-mile cable, half mile uninsulated No. 8 iron wire, and another half-mile cable. The iron wire was laid about bog and into canal. Potential plates zinc and copper; earth plates, iron."

I have succeeded in transmitting signals through nine miles of badly insulated wire placed in a running stream, chiefly on reels in half-mile lengths a few yards apart, by means of potential plates. Each potential plate should expose a larger surface to the earth than the whole of the system, including the line and neutral ground plates.

I see no reason why it should not be possible to signal across the Atlantic through an uninsulated wire by means of potential plates. The longest length of wire I have worked through was forty-two miles. It was a copper-stranded core cable insulated throughout, except at two points, fourteen miles from each end, where about three inches of the insulation was removed, and the uninsulated wire buried in wet soil. The longest length of uninsulated wire was about one and a half miles. This was laid out on a swamp, on wet sandy soil, and in the water of a canal. It was composed half of No. 9 and half of No. 16 B. W. G. iron, galvanized. It was the longest length of uninsulated wire at my disposal.

With zinc and copper potential plates a better result was attained by employing for the line and neutral earths, iron which had not been galvanized. To each end of this one and a half miles of insulated wire I connected five miles of cable, which I worked through as satisfactorily as before the addition. Many of these experiments will be fresh in the memory of several, as I was, when engaged upon them, accused by a wag of holding communication with Satan, and this became a standard joke.

Further, I can assert that it is possible, by means of potential plates, to communicate electrically within a limited distance either in air or water, altogether independent of a metallic circuit. To so communicate, it is only necessary to support a sheet of metal at one station, preferably in such a manner as to expose its largest surface to a similar sheet of metal, supported at about the same level, at another station, treating and connecting the plates as the line in the ordinary case, and otherwise retaining the system and method of working as shown in Fig. 1. While two such plates in air or in water are at the same potential, no electricity passes between them; but, on making one of a different potential to the other, by disconnecting the neutral ground plate and connecting one of the potential plates, electricity will immediately pass from that plate having the highest to that having the lowest potential. Captive balloons can be employed in air to support the plates, or the balloons themselves may be made of metal, and employed in lieu of the plates.

Want of means alone prevented the extended experiments it has been my anxious desire to carry out, and want of space, time and my notes prevent my now entering more fully into details of the numerous experiments I have made with *uninsulated lines* and with potential plates during the last twelve years.

(TO BE CONTINUED.)

New York's Electrical Subways.

At the meeting of the Subway Commission, on August 3, Mr. Kearney, the engineer, submitted some specifications for the first of the new subways. The following are the chief points of interest as adopted:

In general the conduits will be constructed of asphaltic, bituminous or coal-tar mastic, as the commissioners may direct; rectangular, in sections containing a series of holes or ducts 2½ inches in diameter.

The conduit will rest on a continuous foundation or base of Portland cement concrete not less than 6 inches in thickness.

At street crossings and at intersections of line of conduits, manholes or working vaults will be built to provide for the introduction of conductors into the conduit, and also to give access to the conductors when in place. House distribution of conductors will be made from these manholes by means of small lateral conduits or branches.

The commissioners shall have the right to make any alterations, additions, or omissions of work or material specified during the progress of construction that they may find to be necessary, and the same shall be acceded to by the contractor and carried into effect without in any way violating or vitiating the contract.

The strength of the material is to conform to the requirements of the report adopted by the commission on June 30, and the report of the chemist submitted later. The material must be submitted for test to the chemist of the commission before beginning the manufacture of the conduit. The chemist shall inspect all the material and the manufacture of the same into conduits and other forms at the factory, and see that the same strictly corresponds with the requirements of the specifications.

The trench in which the conduit is to be laid shall be of sufficient depth to leave the top of the conduit six feet below the grade of the street. The trench shall be made deeper if so required by the engineers.

The contractors shall provide for the flow of all sewers, drains, and water courses interrupted during the progress of the work, and shall restore and make good all connections.

Each line of ducts between manholes must be air-tight and electrically tight, and will be tested between manholes, before refilling the trench is begun, with an air pump, and must be able to maintain a vacuum of ten pounds and hold it for ten minutes without a loss of more than two pounds, and it will also be subjected to an electrical test. The sections shall not be less than 3½ feet in length.

Branches or distributing ducts, of the sizes to be designated by the engineers, shall be laid from each manhole, to be placed in the side streets, in order to reach the most convenient point on the street to enter the block desired; and when the interior of the block has been reached the wires shall be raised above ground and radiate from that point so as to be distributed to the rear of the various buildings requiring electrical service.

The contracting company is authorized and directed to begin within three weeks from the date of the specifications the construction of a subway at Twenty-third street and Sixth avenue, on the easterly side of said avenue, — feet from the curb, and north along the line of the avenue to Fifty-ninth street, and prosecute the work with due diligence.

The form of the conduit shall be rectangular, and shall consist of two sections containing twelve holes or ducts each, of 2½ inches diameter, laid side by side on the same foundation.

The principal point of interest in the report of Dr. Le-

doux, the chemical expert of the commission, is that it allows the use of natural bitumen, natural rock, asphalt, mastic, or artificial pitch, at the option of the commission, and with conditions as to purity and quality, as to the binding material of the concrete, and requires that the porosity of the sand used and the shrinkage of the pitch or bitumen shall be determined and allowed for before mixture. As to the quality of the binding material the specifications say:

If pitch is used it must be delivered in large lots, and each lot must be shown to conform to the standard. It must not be heated over 325° in distilling or remelting; it must be pliable above 150°, but brittle below that temperature.

If natural bitumen is used it must be absolutely freed from water, and contain in the semi-refined mastic not less than sixty per cent. of pure bitumen.

If rock asphalt mastic is used it must be made from natural rock, carrying not less than eight per cent. bitumen and entirely freed from powdered barren rock, and the mastic prepared therefrom should contain such an additional quantity of natural double refined bitumen as will raise the total contents of bitumen up to not less than seventeen per cent.

The first line of subway will extend along Sixth avenue from Twenty-third street to Fifty-ninth street. It makes no provision, however, for electric light wires, but merely for those of telegraphic and telephonic service.

Application has been made to the commission for privilege to run wires in the new conduits. So far no effort has been made to test the validity of the acts of the commission.

Pigeon Service.—The latest hobby of Mr. Alfred de Cordova, the well-known broker, is that of carrier pigeons. He is at present enjoying a fortune made on "the street" and is leading a luxurious life at his country seat "Chetolah," near Somerville, N. J. He has instituted a half-hourly dispatch by carrier pigeons between his office on Broad street and Chetolah. The arrival of each bird is signaled by an electric bell in his house, which is connected with the pretty and well-organized pigeon house.

The Van Depoele Electric Railway System.

The Van Depoele electric railway system, now in successful operation at so many places in this country, as well as in Canada, is the invention of Chas. J. Van Depoele, the electrician of the Van Depoele Electric Manufacturing Company, of Chicago, Illinois, and it is the result of constant experiment in generators, motors and the transmission of power, beginning in 1874 and running down to the present time.

The Van Depoele generator, Fig. 1, is a model of simplicity, and several changes have been made from the ordinary Van Depoele dynamo* to adapt it to the work of transmission of power.

The Van Depoele motors are of various sizes and styles, from a motor weighing one pound to the eighty horse-power motor weighing eight thousand pounds. The accompanying cut, Fig. 2, illustrates the large motor for running railway trains.

The first railway operated under the Van Depoele system was laid in Chicago in the winter of 1882–3, and the current was conveyed by a wire. In the fall of the same year a car was run at the Industrial Exposition in Chicago from an overhead wire.

In 1884 a train was run at Toronto, Ontario, by the Van Depoele system, using an underground conduit. This road was operated successfully and carried the passengers from the street car line to the Exposition Grounds, and was a perfect success. It was operated as long as the Exposition lasted. This train averaged 200 passengers per trip; the speed was about thirty miles per hour.

In the fall of 1885, at Toronto, the road connecting the Exposition grounds with the street railway, a distance of one mile, was equipped with a Van Depoele motor (Fig. 3). This train consisted of three cars and a motor-car. As there was only one track, it was necessary to run at a high rate of speed. An overhead wire was used as a conductor, it requiring but a few days to put it in operation; an ordinary forty-light dynamo was used, driven by a Doty 10 × 16 engine.

The average speed of the train was about 30 miles per hour. The trains carried from 225 to 250 people and the average number of passengers per day was over 10,000. The amount of coal consumed was 1,000 pounds per day. This road carried all the passengers that could be gotten on and off the cars.

For the purpose of conducting experiments, a portion of the South Bend Railway line was equipped in the fall of 1885 and several independent cars were run with small motors, the generator being driven by water-power. It was a grand success, the cars traveling in different directions from the same conductor. This road has not yet been equipped, however, owing to change in management.

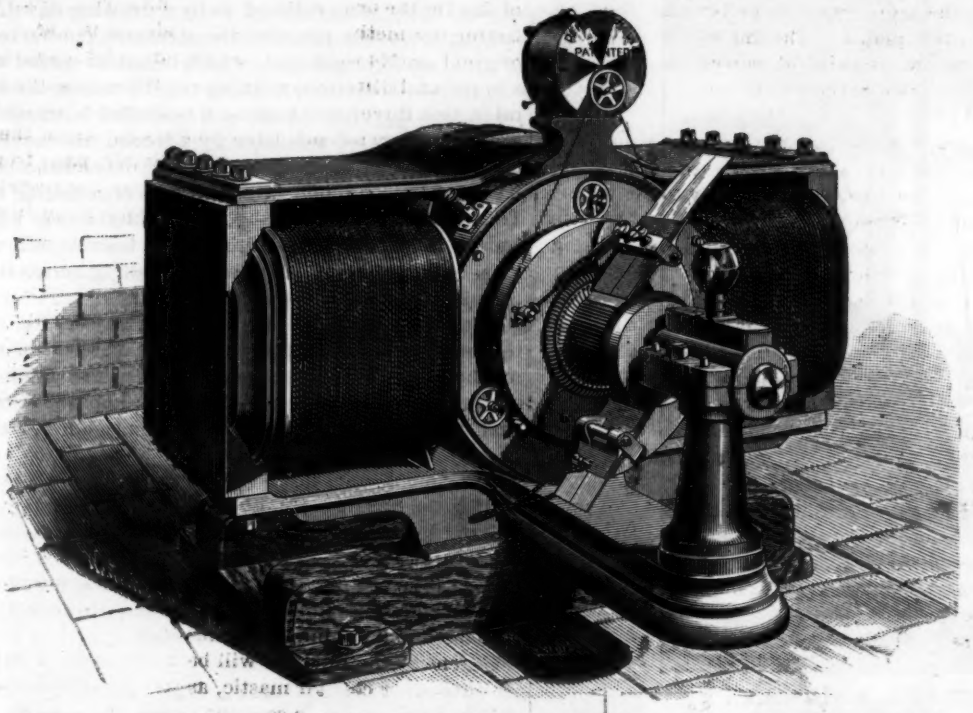


FIG. 1.—GENERATOR—VAN DEPOELE ELECTRIC RAILWAY SYSTEM.

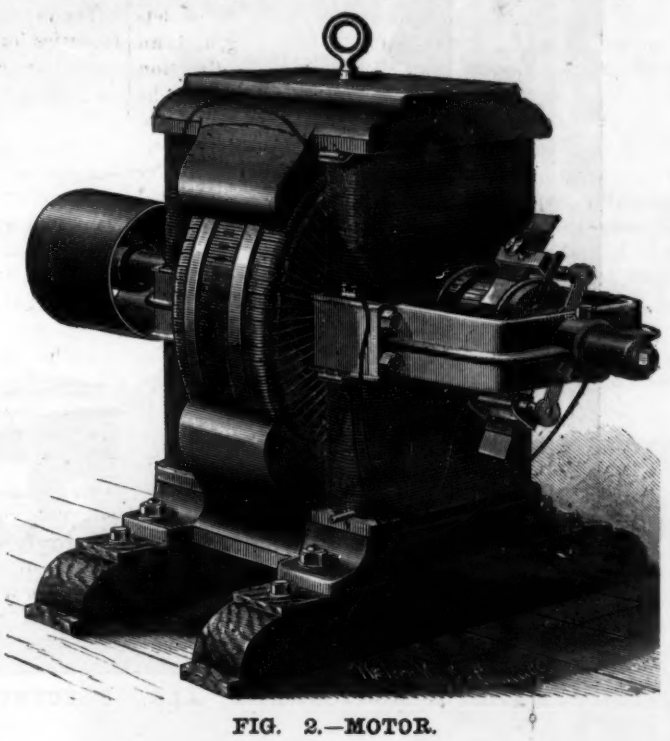


FIG. 2.—MOTOR.

At New Orleans, during the late exposition, a train, consisting of three large cars, was run successfully until the end of the Exposition.

The Minneapolis, Lyndale & Minnetonka Railway Company, of Minneapolis, have been obliged to discontinue the running of their locomotives in the more thickly settled portions of the city of Minneapolis, and an arrangement was made to bring the cars into the city and deliver them back to the steam locomotives. This is being done successfully (Fig. 4). The motor is located upon a cheaply constructed motor-car and takes the current from an overhead copper wire. The generator is placed quite a distance from the track, and is driven by an old slide-valve engine, 12 × 18 cylinder, making 125 revolutions per minute. The consumption of coal is about 3,000 pounds for seventeen hours' run. Forty-eight trains are run each way daily, running from 6 A. M. to 11:30 P. M. Trains are composed of from three to four closed railway coaches weighing eleven tons each, or of a larger number of open cars weighing six tons each. As many as eight of these cars have been hauled at one time, and this up a grade of 3½ per cent., and the cars crowded to their utmost capacity with passengers, giving a total of 91 tons. The motor works perfectly.

At Montgomery, Ala., the Capital City Street Railway

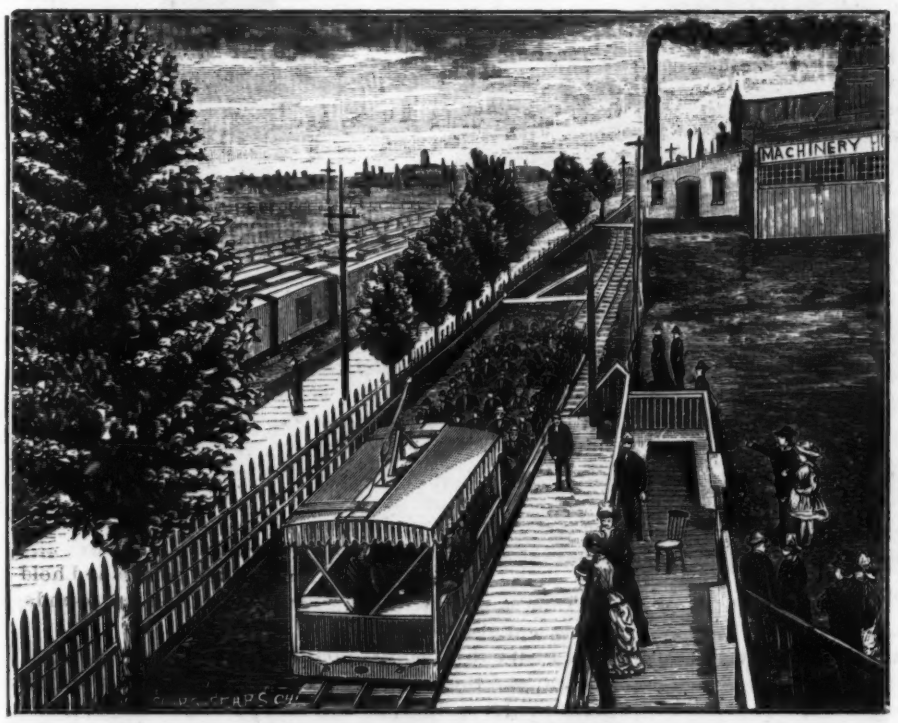


FIG. 3.—TORONTO RAILWAY.

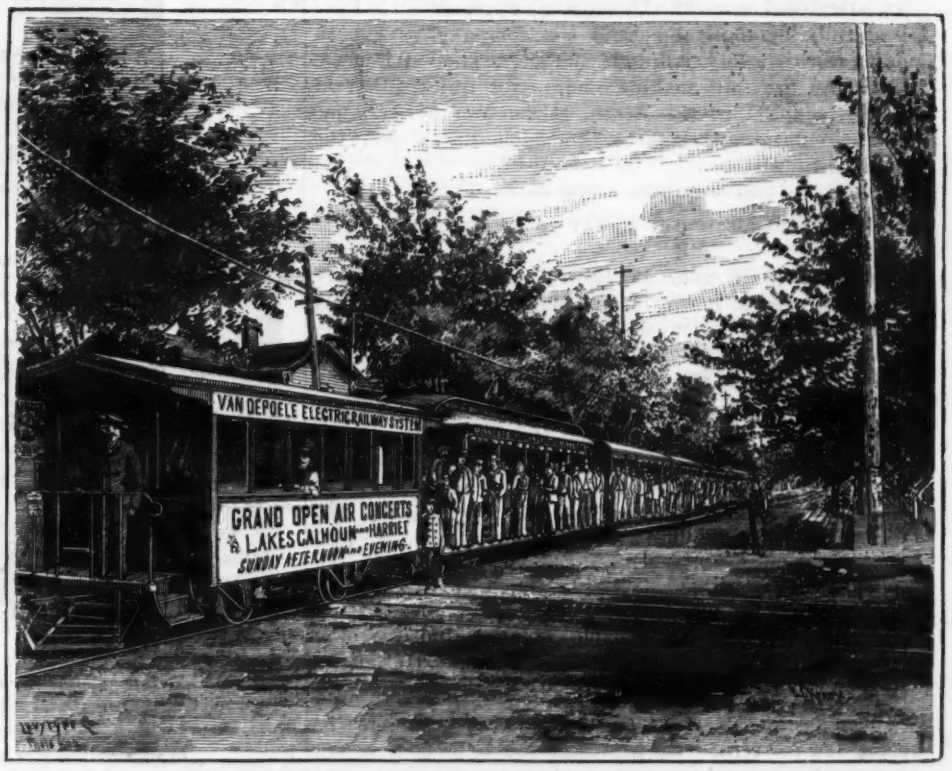


FIG. 4.—MINNEAPOLIS RAILWAY.

* The Van Depoele electric lighting system was illustrated and described in THE ELECTRICAL WORLD, September 27, 1884.

have been running two cars for some time (Figs. 5 and 6). The grades are over seven per cent.; the distance is over 1¼ miles. Motors are placed on the platform of each car and do the work well. The speed over the grade is six miles per hour. The cars run 16 hours per day, and the generator is driven by an old-fashioned slide-valve engine stationed 250 feet from the boiler. The amount of coal consumed per day is 3,000 pounds, including getting up steam from cold water.

At Windsor, Ontario, a train has been running on the track of the Windsor Electric Street Railway Company since June 6, and giving good satisfaction. The distance traveled is about two miles.

The Appleton Electric Railway at Appleton, Wis., is nearly completed and will have five cars run separately. The generator will be run by water-power.

At Detroit, Mich., the electrical apparâtus on the Dix road will all be complete as soon as the track is laid, which will be Aug. 15.

At Scranton, Pa., the Scranton Suburban Railway Company have adopted the Van Depoele system, and the road will be in operation by Oct. 1 next.

The Van Depoele Company have now several contracts in hand to be completed at later dates. As to the competency and durability of the apparatus of the Van Depoele system there should be no further question. It is evidently an established success. Its economy appears also to have been fully demonstrated, and the company have been doing work of a very creditable character. The Van Depoele Company are now making motors for transmission of power, adapted to the Brush, Edison or other systems, and are enlarging their factory to enable them to meet the demand for motors.

FIG. 5.—MONTGOMERY, ALA., ELECTRIC STREET RAILWAY.

Transmission of Power in Switzerland.

In a little place called Dorenberg, close to the railway from Lucerne to Berne, in Switzerland, there are an old iron-works and a flour-mill which received water power from a joint canal, having a fall of 33 feet, and yielding 250 h. p. There is also the facility for increasing both the quantity of water and the fall at very slight expenditure by utilizing the River Emme, and thus 400 h. p. might be obtained in future. At present, however, the 250 h. p. alone are utilized by a society which was constituted some time ago in Lucerne, and which has for its object the supply of electric light and motive power to the town and its neighborhood. The motive power is obtained at the mill in Dorenberg, by means of a Girard turbine. Its speed is controlled by a governor, which acts upon a throttle valve, and by a new type of regulator actuated by water power invented by Herr Schrieder. The regulation is so perfect that a sudden drop in the power required of even as much as 100 h. p. only results in a difference of speed of 2 per cent. Of the total 250 h. p., 60 h. p. are transmitted to a distance of nearly two miles, and are to be utilized in an establishment known as the Fluhmühle, near Lucerne. This is done by means of an electric current, conducted along a copper wire of 380 mils diameter, and supported overhead in the usual way on telegraph posts. There is a separate out-and-home circuit. The dynamos and motors for this installation have been supplied by MM. De Meuron & Guenod, of Geneva, who guarantee a commercial efficiency of 60 per cent. The power required at Dorenberg for this purpose is therefore 100 h. p. At the generating system there are two belt-driven dynamos of the Thury pattern, each of them capable of giving a current of 58 ampères at an electromotive force of 500 volts, when driven at a speed of 400 revolutions per minute. It has six poles and three pairs of brushes. The two generating dynamos are coupled up in series, and thus the E. M. F. of 1,000 volts is obtained. The loss of pressure along the line is about 100 volts, and at the receiving station at Lucerne there are two dynamos, but of somewhat smaller size, which are also coupled in series, and from which the 60 h. p. are obtained. This is the portion of the installation which is devoted entirely to the transmission of power. Another portion of the same installation is devoted to lighting purposes, and consists of two alternating current dynamos of the Zipernowski-Deri type, each capable of delivering a current of 38 ampères at an E. M. F. of 1,800 to 2,000 volts.

These dynamos are driven by spur gear. The conductor is also placed overhead, and consists of four bare copper wires, each 240 mils diameter. Two of these serve for the out, and the other two for the home circuit. The total distance between the dynamos and the lamps is about 3½ miles. There are seven transformers distributed in the different buildings where the light is required. All the transformers are placed in multiple arc, and each is capable of producing 7,000 watts in the secondary circuit. The pressure at the terminals of that circuit is either 28 or 56 volts, according to the way of using the secondary coils.

FIG. 6.—MONTGOMERY, ALA., ELECTRIC STREET RAILWAY.

The total number of lamps now in use is 1,200, consisting partly of 10-candle and partly of 20-candle lamps.

An Auroral Display in New England.

A remarkable auroral display was witnessed in New England and the northern portion of the Middle States on the 27th ult. It is said to have been the most striking exhibition of the kind since 1882. About 4 P. M. the first effects of a magnetic disturbance were felt, and the most notable results were manifested between 10 and 11 P. M. This appearance of the northern lights was not a surprise, for the sun had for several days before been undergoing a lively struggle within itself. Its spots increased in size and attracted attention. Although daylight, the sensitive telegraphic instruments, even before 4 o'clock, began to show the peculiar disturbing influence which always foretells the appearance of the aurora. The weather was cloudy at the time, but the gradually increasing difficulty in working the wires showed that the magnetic disturbance was growing in intensity. Just before 9 o'clock the heavy thunder clouds that obscured the northern horizon broke away, and the observers who happened to be out got a first view of the celestial pyrotechnics. At first there was a great unbroken arc, stretching from northeast to northwest, over ninety degrees of the horizon being covered by it, and it reached to the zenith. At 9 o'clock the arch was dissipated into innumerable streamers of a beautiful roseate hue. For two hours these streamers danced and flickered. Knots of people stood on the streets in Boston admiring the phenomena. The best view was had from Roxbury.

The climax was reached at 11 o'clock. In the exact north, about two degrees above the horizon, there suddenly shone a point of intense white light. In a few minutes it had spread out into a fan-shaped streamer, reaching far beyond the zenith. It was of such brilliancy that the stars of the Dipper were eclipsed as by a growing dawn. After lasting some ten minutes the streamer contracted to its original small bright spot, which began to spread again in a horizontal direction, running rapidly across the horizontal in two directions, making a beautiful bow, which was followed a few seconds later by a second and smaller one, making distinct arches, from which depended a beautiful fringe of light, giving the appearance of a falling curtain. This exhibition is seldom seen save in the very high latitudes. By midnight the aurora had become only a broad glare, with an occasional streamer flashing across it, which lasted until the dawn of day.

The effect upon the wires was quite serious. All the telegraph companies report the electrical storm the severest northeast of Boston, through Maine toward the maritime provinces. The Western Union was almost shut out from that region between 7 and 10 o'clock, while to the west the effect was hardly noticed. Even upon such local circuits as the district messenger and telephone service there was much trouble. Many call boxes where the current was weak were rendered temporarily useless, and several districts of the telephone service were cut off from the city. Toward Woburn the telephones could not be worked for several hours, and in the city a large number of individual instruments were out of circuit. After 11 o'clock the troubles began to decrease.

Swift's Snow-Storm.

"Talking about the signal service and its bad luck in the weather prophesying business," said a station agent, "let me tell you a little story about Swift, superintendent of telegraph on the Rock Island. Some time last winter the signal service people told Swift they would furnish him their bulletins if he would undertake to send them out and have them posted along the road. Swift accepted the offer, and thought it a big thing. He had instructions sent out to all operators concerning posting of the weather bulletins, and felt so proud of the new service that he went around bragging what a good thing it would be. In a few days the signal service predicted a very heavy snow-storm, and Swift sent word to the superintendents suggesting that they had better make arrangements in advance to keep the tracks clear of the unusual fall of a snow sure to come.

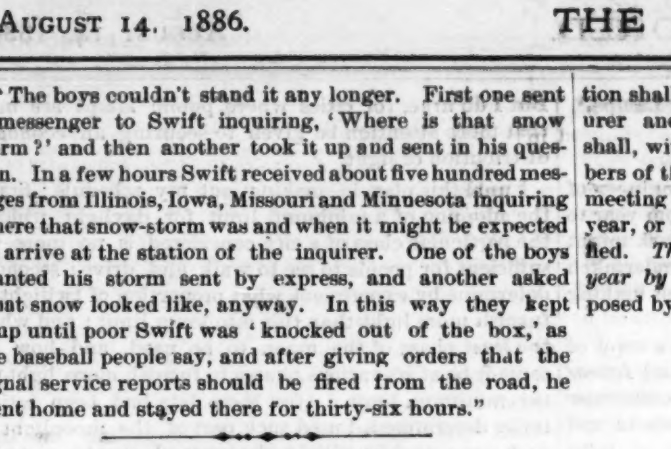
"'Now, you see,' he said, 'how valuable this service is to a railroad. When that snow comes we'll be prepared for it and not a wheel will be stopped.'

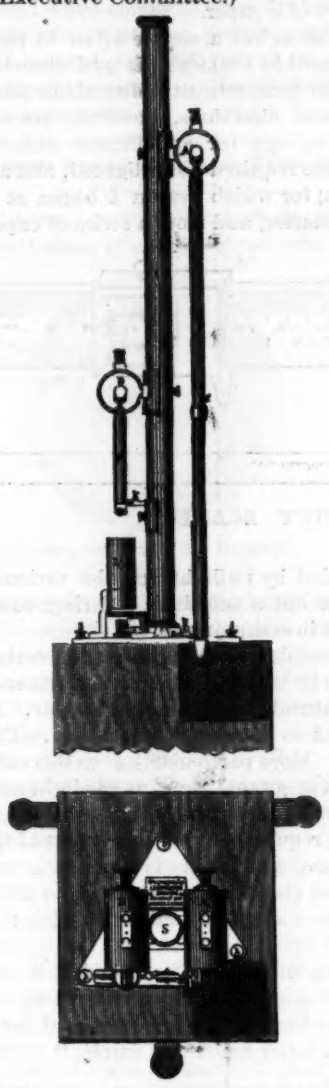
"Instructions were sent out to station agents and section bosses, and in some places gangs of extra laborers were hired to shovel snow. But the snow-storm didn't seem to be in a hurry. The day passed as bright and clear as one could ask for; the night following was equally as pleasant and the next day started in as clear as a morning in June, with no sign of snow to be discerned.

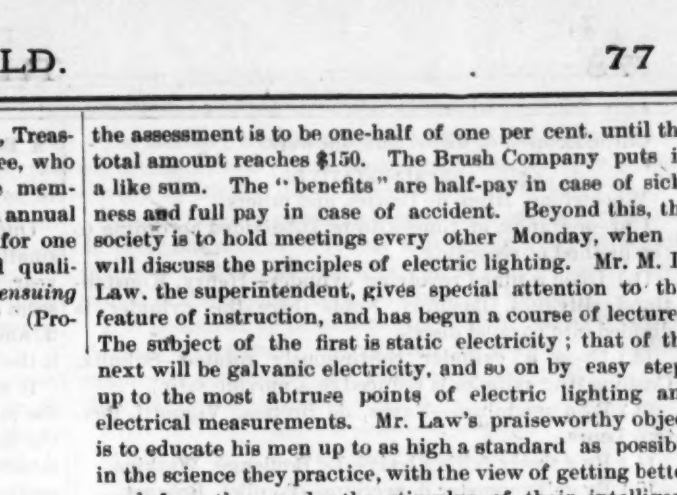
"The boys couldn't stand it any longer. First one sent a messenger to Swift inquiring, 'Where is that snow storm?' and then another took it up and sent in his question. In a few hours Swift received about five hundred messages from Illinois, Iowa, Missouri and Minnesota inquiring where that snow-storm was and when it might be expected to arrive at the station of the inquirer. One of the boys wanted his storm sent by express, and another asked what snow looked like, anyway. In this way they kept it up until poor Swift was 'knocked out of the box,' as the baseball people say, and after giving orders that the signal service reports should be fired from the road, he went home and stayed there for thirty-six hours."

Telephonic Progress in France.

The proposed changes in France relative to the telephone are far-reaching. All the telephonic lines in France are, under the new plan, to become the property of the State, but are to be worked under its surveillance by a company, which is to buy out all existing interests. The company is further (1) to provide gratuitously telephonic communication to every commune in France which has not already a telegraphic office, and (2) to every town from which 30 subscriptions may be guaranteed. The advantages thus given to the country will be very great. In the first place, all the rural districts which are at present shut out from the telegraphic trunk lines will be put into communication with them by telephone. Telegraphic messages, which are now transmitted to these villages by special messenger at considerable cost, will in future be sent on by telephone without any extra pay ment. Then, in the second place, towns of the second and third rank which have not yet started an exchange will be given one. Among the places which will be benefited in this way are Avignon, Montpellier, Toulouse, Nîmes, Dijon, Macon, Amiens, Boulogne, Caen, Rennes and Orleans. The price of subscriptions in towns where the telephone is already installed is also to be reduced—in Paris from $120 a year to $80, and in provincial towns from $80 to $60. The advantages to the public and to the State (which gets the possession of the whole telephone system for nothing, the concession to the new company being for 35 years only) are obvious; whether the arrangement will be equally advantageous to the company remains to be seen. In any case it is not to be allowed to reap too much profit, for as soon as it begins to pay more than 6 per cent. dividend, 15 per cent. of its surplus profits is to go to the State.







FIGS. 5, 7 AND 8.—LE BOULENGE CHRONOGRAPH.

National Telephone Exchange Association.

Gen. C. H. Barney, secretary of the above association, makes the following preliminary announcement of the programme for the St. Louis meeting, to begin September 7 at 11 A. M.: Beside the annual address of the President, and the general report of the Secretary, the following papers will be read and discussed at the meeting, viz.: "Long-Distance Telephoning," by A. S. Hibbard, Esq., of the Wisconsin Telephone Company; "Legislation of the Past Year," by H. L. Storke, Esq., of the Hudson River Telephone Company; "Cables and Underground Work," by C. N. Fay, Esq., of the Chicago Telephone Company; "Statistics," by the Secretary; "The Necessity of Protecting Telephone Exchanges, circuits and appliances from the destructive effects of intense electric currents and discharges," by Thomas D. Lockwood, Esq., of the American Bell Telephone Company; "Underground Work in Brooklyn," by W. D. Sargent, Esq., of the New York and New Jersey Telephone Company. Several other papers are partially promised.

Several proposed changes in the constitution—laid over from the last annual meeting—will come up for action. If adopted, the several articles and sections amended will read as follows, the changes being in italics:

"ARTICLE XIV., Section 1.—The admission fee shall in all cases be ten dollars, to be paid on signing the constitution. The annual dues shall be *fifty* dollars for each vote now had or that may be hereafter acquired under the constitution, and shall be payable yearly on or before the first day of July in each year." (Proposed by the executive committee.)

"ARTICLE IV., Section 1.—The officers of this Association shall be a President, Vice-President, Secretary, Treasurer and an Executive and Advisory Committee, who shall, with the exception of *the Secretary and* the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified. *The Secretary shall be appointed for the ensuing year by the newly-elected Executive Committee.*" (Proposed by the Executive Committee.)

"ARTICLE XVII., Section 1.—*Any person may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such election to be by ballot.*" (Proposed by Mr. E. J. Hall, Jr.)

"ARTICLE XVIII. (Additional Article.) Section 1.—*Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.*

Section 2. *An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, and shall be subject to the same dues and assessments.*" (Proposed by Mr. E. J. Hall, Jr.)

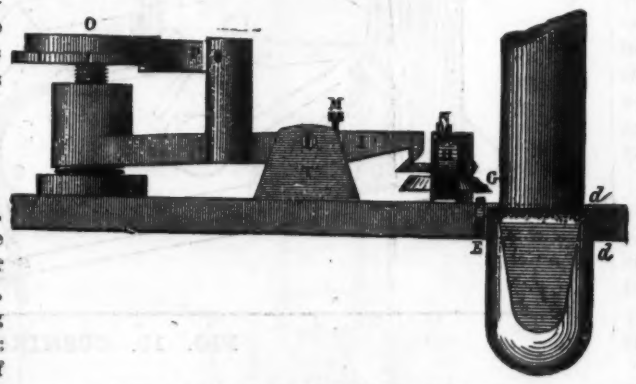


FIG. 6.—THE LE BOULENGE INDENTER.

The following change in the By-Laws was proposed at the last meeting by Mr. H. L. Storke, and will come up for action. It is an additional section to Article III.

"Section 5. *The Secretary shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the telephone business as have heretofore been furnished by the various committees of this Association.*"

The attendance promises to be unusually good.

An Electric Light Beneficial Society.

The Brush Electric Light Company of Philadelphia has organized a beneficial society of which the second meeting was held on the 9th inst. The society has 40 members, all employés of the company, and it is one of the rules that membership ceases on withdrawal from the company's service. Each member is assessed one per cent. of his salary until there is $100 in the treasury; and after that the assessment is to be one-half of one per cent. until the total amount reaches $150. The Brush Company puts in a like sum. The "benefits" are half-pay in case of sickness and full pay in case of accident. Beyond this, the society is to hold meetings every other Monday, when it will discuss the principles of electric lighting. Mr. M. D. Law, the superintendent, gives special attention to this feature of instruction, and has begun a course of lectures. The subject of the first is static electricity; that of the next will be galvanic electricity, and so on by easy steps up to the most abtruse points of electric lighting and electrical measurements. Mr. Law's praiseworthy object is to educate his men up to as high a standard as possible in the science they practice, with the view of getting better work from them under the stimulus of their intelligent interest in whatever they do.

The Applications of Electricity to the Development of Marksmanship.*

BY CAPT. O. E. MICHAELIS, U. S. A.

(*Concluded.*)

In 1863, Colonel Le Boulengé, of the Belgian Army, a most talented officer, devised his chronograph, Figs. 5, 6, 7 8 and 9, which, toward 1870, on account of its accuracy, simplicity, portability and cheapness, was adopted in all countries. A falling body is a good time-piece, but it must not be interfered with. He suspended a long rod by an electro-magnet, which begins falling upon the rupture of the first target. Upon the rupture of the second target another rod, also suspended by an electro-magnet, drops upon a lever, thereby releasing a spring knife, which, in jutting forward, dents the first rod in its fall. The position of the dent on the rod gives the amount of fall, hence the time, and, as before, the velocity. As with the Navez and Benton machines, an ingenious disjunctor determines the instrumental time. The great practical merit of the instrument lies in the fact that this instrumental time can be made *constant*, which permits us to measure off the *velocity* directly from the rod.

This is done as follows: Assume 100 feet between the targets an instrumental error of 0.15 second, and an initial velocity of 1,200 feet. Divide the space, 100 feet, by the velocity, 1,200 feet, and we have the time, .08⅓ second, of passage between the targets; to this add the 0.15 second instrumental time, and we have .23⅓ second for the time of fall of the rod, corresponding to a distance of ten and one-half inches. Therefore, in our measure, where usually we engrave ten and one-half inches, we would here put 1,200 feet. Of course, it is easy to extend this throughout the whole length of fall. Any one of ordinary intelligence and gentle touch can easily be taught to manipulate the instrument.

And now, in conclusion, I will show you the latest American invention in this department of applied science, a contribution to the Electrical Exhibition, the Cushing velocimeter, Fig. 10. We have here the simplest and most constant of all minute time-dividers, an electrically controlled tuning fork, and the Morse recording ribbon sensitized for the galvanic current. Mr. Cushing certainly deserves great credit for thus ingeniously combining two well-known and easily controlled devices, and producing an apparatus, which, while not yet sufficiently accurate for profound scientific research, offers a simple, economical, and correct method for ordinary testing.

In operating the instrument, the paper strip is reeled off by hand; upon it rest three fine iron wires, through the centre one passes the vibratory current (not Keely's), that controls the fork, or rather reed, for the fork is reduced to one tine, through the other two, the respective target currents. The centre wire records a continuous dotted line corresponding to the reed's vibrations, the other wires trace straight lines. Upon the rupture of the currents at the targets, these lines are broken. The number of vibrations and fractions recorded between the breaks gives the time. You see that the Cushing velocimeter is the Schultz chronoscope in "shirt sleeves."

To recapitulate, the electric instruments for measuring initial velocities devised up to the present time may be classified as follows:

* Abstract from a lecture delivered before the Franklin Institute.

Chronoscopes, or direct time-showers.

REPRESENTATIVES.

Wheatstone, Hipp, de Brettes, and others.

Chronographs, or time-writers, subdivided according to the method of recording.

(1.) Upon a timed revolving cylinder—Henry, Konstantinoff, Breguet, Bashfort, Noble (here the cylinder is divided into parallel discs).

(2.) Upon a cylinder continuously rotated—Schultz, Cushing (the cylinder is reduced to a moving strip).

(3.) By a pendulum—Navez, de Brettes, Vignotti, Benton, Leurs.

(4.) By a freely falling body—Le Boulengé, Watkins.

(5.) By galvanometer deflections—Pouillet, Bréguet.

I hope that in this lengthy, sometimes necessarily technical, paper, I have made one thing clear to you, that the application of electricity to the determination of

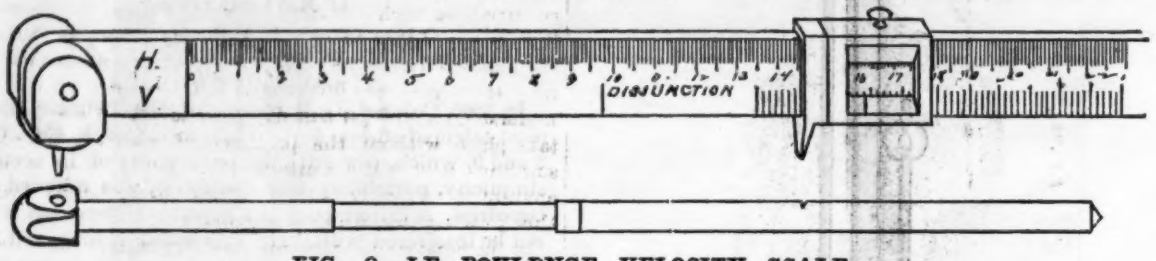


FIG. 9.—LE BOULENGE VELOCITY SCALE.

initial velocity has reduced the cumbersome ballistic pendulum, an apparatus, to the simple chronograph, a tool; that it has done away with all abstruse calculation, and has substituted therefor the method of the foot rule; that it has made it possible for every powder manufacturer to do his own proving. He can now ascertain the velocity of his powder as easily and surely as the apothecary weighs the ingredients of a prescription. He knows what is required—he can produce it, not once, but always. He can make a constant powder, and, as I endeavored to show you in the beginning, upon the uniformity of the powder depends the accuracy of the marksman.

[Captain Michaelis also described the Vignotti, Benton and Schultz electro-ballistic chronoscopes, which were illustrated in THE ELECTRICAL WORLD, August 8 and 15, 1885.]

The Working of Telephonic Apparatus.

To the Editor of The Electrical World:

SIR: In last week's issue of THE ELECTRICAL WORLD appeared an article in reference to the recent telephone suit at New Orleans and in which some statements were made in regard to the working of telephonic apparatus, which leads me to the conclusion that Mr. Guest simply guessed (not a pun) at the points he endeavored to make.

I have been actively engaged in the electrical business for several years and have made many forms of transmitters, the Reis among others, and can say that the Reis transmitter, as originally constructed, will not produce speech.

The Reis transmitter consists of two platinum electrodes so arranged that when one is made to vibrate it will at each forward movement come in contact with the other electrode, thereby completing the circuit and breaking it at each backward movement. That the current will be an intermittent one is obvious, and, although the waves are reproduced at proper intervals, the impulses are all of the same strength, as they are all produced by the same current strength; the pitch only will be reproduced, and pitch is only one of the characteristics of sound.

Whether the action of the Blake transmitter is due to the compressibility of the carbon or otherwise has no bearing on the Reis. That the resistance of carbon varies with the amount of pressure to which it is subjected is easily demonstrated, and this, together with the varying resistance of the actual contact between the platinum and carbon, is undoubtedly the real cause of its working.

I have never seen any form of transmitter which would transmit articulate speech in which the electrodes were made to separate by vibration. If they do separate, a "breaking up" is the result and the instrument does not articulate properly.

In attempting to construct a telephone repeater, I demonstrated to my satisfaction that the diaphragm of the receiver *does move*.

I also take exception to the statement that an electro-magnet inserted in the secondary wire of an induction coil will not show any effect upon closing or opening the primary. I have accomplished this many times.

An undulatory current may be generated by the vibration or motion of bodies capable of inductive action. In the case of two electro-magnets inserted in a battery circuit having armatures in front of their poles the armatures themselves become magnets by induction, and the lines of force in the field created by the magnets are concentrated or scattered by the vibration of the armature, in consequence of which the magnetic strength of the core of the electro-magnet is varied, and reacting upon the wire surrounding it causes changes in the complete circuit.

B. C. W.

ELMIRA, N. Y

A Revised Time-Table for Lighting Public Lamps.*

BY JULIUS M. HOWELLS.

One of the tedious tasks that falls to the engineer of small cities is that of making out time-tables, from year to year, for the lighting of public lamps. This task might seem comparatively easy to one who had never undertaken it, and hardly of sufficient importance to warrant making it the suject of a paper.

It would seem but a simple affair to procure a copy of the tables used in Philadelphia and elsewhere and follow the short but comprehensive directions printed with those tables. These directions, however, are not definite and particular enough for an efficient distribution of light over the time required to be lighted, and allow a waste at other times; for which reason I began at the bottom of the whole matter, and from a series of experiments on the light afforded by twilight and the various phases of the moon made out a schedule differing considerably from other tables in common use.

This subject deserves attention, for certainly hundreds of lamps to be burning while the streets are amply lighted from the natural source is a great waste. Also it is very inconvenient to have no light at times, either naturally or artificially. More particularly does this subject seem important at the present time, as gas-light may soon be generally superseded by electric light, when lighting and extinguishing requires but the movement of the hand. Thus, as an instance, when a city is depending on a half moon for light, and clouds should come up to obscure its light, it would be but a simple operation to bring the public lamps into effect.

In lighting cities by any method it is very desirable to have an economically-disposed lighting schedule. If a city is limited to 2,000 or 2,200 hours of lamp-light for the year, which latter amount is ample, it requires a very nice distribution of light to avoid, at times, total darkness. Some cities, in public lighting, take no cognizance of moonlight, and street lamps blaze all night long. Their flames look pale enough, almost casting shadows in the bright light of a harvest moon. This thriftless disregard for economy is inexplicable, when with a properly-organized lamp-lighting force a tenth part of the light burned during moonlight nights, put at the disposal of an efficient officer—say, the chief of police—would light the nights when clouds obscure the moon, and the whole period of moonlight nights would be just as well lighted. Such an officer gets ample warning from the signal service reports, and from an outlook for sudden changes of weather, and could order lamps lit and have them burning almost before the sky could become overcast.

Some cities light up in the evening, and extinguish at, or soon after, midnight. In such a place one who finds it necessary to venture out after lights are extinguished, unless provided with a lantern, finds out the inconvenience of such a plan, often to his sorrow, if not his peril.

It is not my object to advocate the burning of more gas than the finances of a place will warrant. Some towns find it necessary to go without public lamps altogether. But I do urge, for cities where public lamps are in use, that more attention be given to securing an economical distribution of light.

I used this plan in making out my schedule: first, by the adoption of a minimum limit for daylight, which, in the particular class of a city considered, is no more than sufficient for people to see to walk and drive; second, to determine by experiment what proportion of twilight will furnish more light than this minimum limit; and what is the least phase of the moon to be used, and how high must it be at its various phases to furnish more light than this minimum limit. After these data had been satisfactorily determined, I used such part of the moonlight and such per cent. of twilight determined as above, and set aside about 125 hours to be used when clouds darkened the moon and twilight. In reserving these extra hours their number is, of course, influenced by local climate.

The conditions under which our experiments were made were these, viz., a city of 18,000 inhabitants, lighted by 266 public gas lamps of 16 candle-power; width of streets from 50 to 80 feet; business houses on the broadest streets and standing on line of street; the buildings in blocks so that the moon does not shine between them; there are no shade trees on business streets. The residence streets average 66 feet wide; houses in some instances stand on the line of the street, but are separate, allowing the moon to shine between them; here there are many shade trees. As to climate, about the average amount of cloudy weather for an inland city, and little fog or smoke.

First as to moonlight. Under these conditions we find when the moon is full and half an hour up it shines high up on the faces of business buildings facing east and west, and at this phase and time, after raising the minimum limit of light, is reflected to the street. Here, also, shop windows may add much to the light. On residence streets also, when the moon is full and half an hour up it shines between the houses and through the trees as well as being somewhat reflected, furnishing light more than the minimum limit. Next as to the *least* phase of the moon when its light exceeds the limit and how high must it be. Our experiments proved that the moon at one day larger than at one-eighth and two hours high will give light in the streets to exceed the minimum. Also that the moon for lighting is practically full for three days.

We now proceed to schedule our conclusions for those days first, when the moon would affect the time of lighting and extinguishing. Also adopting this rule as conforming to the conclusions drawn; viz., one hour and forty minutes equals the time the moon should be up at either quarter; and increasing this time toward new moon and diminishing toward full moon ten minutes each day, make two hours the greatest limit and leaving the least limit to fix itself by reaching the time of full moon all night.

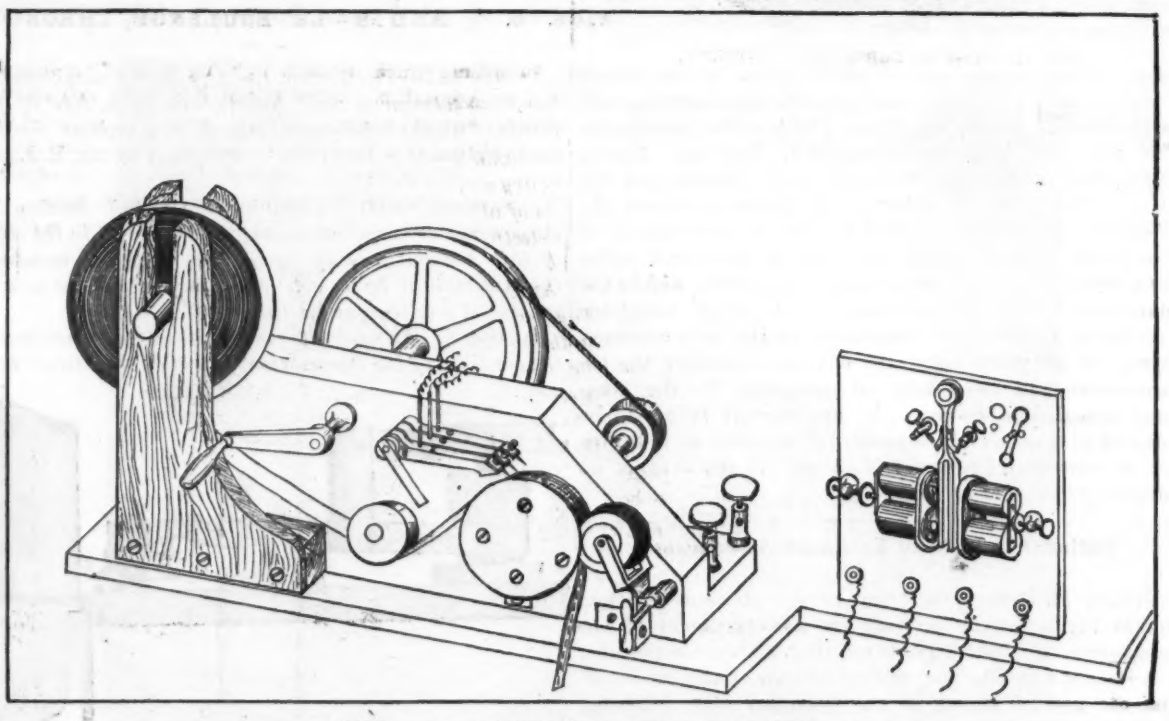


FIG. 10.—CUSHING'S VELOCIMETER.

The following is the moonlight schedule:

(COPIED FROM CALCULATIONS FOR JUNE, 1885.)

Day of month	1	2	3	4	5	6	7	8
Phase of moon					¼			
Time to light before moon sets, or to extinguish after moon rises	h m 1 00	h m 1 10	h m 1 20	h m 1 30	h m 1 40	h m 1 50	h m 2 00	h m
Time moon sets								
Time moon rises	10 13	10 48	11 23	11 56	12 28	1 00	1 32	2 08
Time to light lamps								
Time to ext'g'h "	11 13	11 58	12 43	1 26	2 08	2 50	3 32	

Day of month	12	16	17	18	19	20	21	22
Phase of moon	N'w				¼			
Time to light before moon sets, or to extinguish after moon rises	h m	h m	h m 2 00	h m 1 50	h m 1 40	h m 1 30	h m 1 20	h m 1 10
Time moon sets		11 17	11 51	12 24	12 56	1 29	2 05	2 43
Time moon rises								
Time to light lamps			9 51	10 34	11 16	12 00	12 45	1 33
Time to ext'g'h "								

*Journal of The Association of Engineering Societies, July, 1886.

Day of month	23	24	25	26	27	28	29	30
Phase of moon	.....	.....	.....	.....	F'll	.....	.....	.....
Time to light before moon sets, or to extinguish after	h m	h m	h m	h m	h m	h m	h m	h m
moon rises	1 00	50	40	30	30	30	40	50
Time moon sets	3 23	.....	.....	.....	.....	.....	.....	.....
Time moon rises	.....	.....	.....	.....	.....	8 13	8 50	9 25
Time to light lamps	2 33	.....	.....	.....	.....	...	.....	.....
Time to ext'g'h "	.....	.....	...	...	.....	.....	9 30	10 15

Before considering twilight let us look at the "Directions for Public Lighting," used by the city of Philadelphia, from which are made standard tables. They are: "Light half hour after sun sets. Light one hour before moon sets. Extinguish one hour before sun rises. Extinguish one hour after moon rises."

From what has been shown regarding the light afforded by the moon in all its phases, these directions must at once appear altogether too general. As to twilight, when we remember that the length varies from two hours and six minutes in June to one hour and thirty-two minutes in September, it is easy to see that the use of *any constant* the year around gives no uniform limit of light.

In my experiments the length of twilight was determined for each day of the year and 60 per cent. of it used, as found to be sufficient for street lighting. The time when twilight began and ceased was conveniently determined by a movable planisphere of the heavens, accurately made by Addison H. Study, of Richmond, Ind., to whom

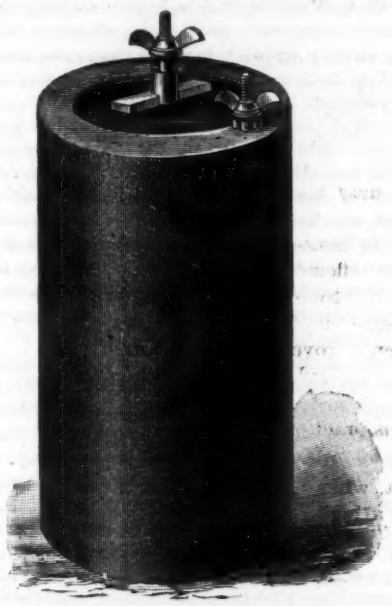


FIG. 1.—THE ROBERTS DRY BATTERY.

I am indebted for its use. Thus we schedule the calculations for twilight as for moonlight, setting in their proper columns the results taken from the above table for moonlight. In the schedule the moonlight results are separated from the twilight results by a *.

Days of month	1	2	3	4	5	6	7	8
	h m	h m	h m	h m	h m	h m	h m	h m
60 per cent. of twilight	1 14	1 14	1 14	1 15	1 15	1 15	1 15	1 15
Time sun sets	7 22	7 23	7 23	7 24	7 25	7 26	7 26	7 26
" " rises	4 33	4 33	4 32	4 32	4 32	4 32	4 31	4 31
Time to light lamps, to nearest 5 min	8 35	8 35	8 40	8 40	8 40	8 40	8 40	8 40
Time to extinguish, to nearest 5 min	11 15	12 00	12 45	1 25	2 10	2 50	*3 15	3 15
Number hours lighted	2 40	3 25	4 05	4 45	5 30	6 10	6 35	6 35

Days of month	9	10	11	12	13	14	15	16
	h m	h m	h m	h m	h m	h m	h m	h m
60 per cent. of twilight	1 15	1 15	1 16	1 16	1 16	1 16	1 16	1 16
Time sun sets	7 27	7 27	7 37	7 28	7 28	7 29	7 29	7 30
" " rises	4 31	4 31	4 31	4 31	4 31	4 31	4 31	4 31
Time to light lamps, to nearest 5 min	8 40	8 40	8 45	8 45	8 45	8 45	8 45	8 45
Time to extinguish, to nearest 5 min	3 15	3 15	3 15	3 15	3 15	3 15	3 15	3 15
Number hours lighted	6 35	6 35	6 30	6 30	6 30	6 30	6 30	6 30

Days of month	17	18	19	20	21	22	23
	h m	h m	h m	h m	h m	h m	h m
60 per cent. of tiwlight	1 16	1 17	1 17	1 17	1 17	1 17	1 17
Time sun sets	7 30	7 31	7 31	7 31	7 31	7 32	7 32
" " rises	4 31	4 31	4 31	4 31	4 31	4 32	4 32
Time to light lamps, to nearest 5 min	*9 50	10 35	11 15	12 00	12 45	1 35	....
Time to extinguish, to nearest 5 min	3 15	3 15	3 15	3 15	3 15	3 15	...
Number hours lighted	5 25	4 40	4 00	3 15	2 30	Not lighted.	

Days of month	24	25	26	27	28	29	30
	h m	h m	h m	h m	h m	h m	h m
60 per cent. of twilight	1 17	1 17	1 17	1 17	1 17	1 17	1 17
Time sun sets	7 32	7 32	7 32	7 32	7 32	7 32	7 32
" " rises	4 32	4 32	4 32	4 32	4 32	4 32	4 32
Time to light lamps, to nearest 5 min	....	....	....	.....	.....	8 50	8 50
Time to extinguish, to nearest 5 min	....	.....	.....	.....	.....	9 30	10 15
Number hours lighted	....	.....	.....	.....	.....	.....	1 25

In combining the two foregoing tables for moonlight and twilight, it is obvious where the one should leave off and the other commence, as the point of change is where the two tables approach the same time. Next we calculate the hours of gas-light, and when they are for any night less than one hour and thirty minutes, it is not worth while to light up; unless such short interval of darkness occurs early in the evening, when many people are out, when it may be best to light up for a single hour,

Lastly we foot the hours lighted for the entire year, and find we have about 2,000 hours. If our contract with the gas company is for 2,200 we have still some to spare. We can make our table to light 15 min. earlier through the entire year, which we had better do, leaving the extinguishing at the first schedule time, except where, on account of moon, we extinguish before eleven o'clock, on which nights we might extinguish ten minutes later.

This completes our table. We again foot up the hours lighted, and have still some 125 hours which are reserved to be ordered used when clouds obscure the moon.

I have the length of nights, twilight, etc., expressed graphically on a large sheet, from which it is a simple operation to read off the minimum limits of light as shown by the above twilight table.

A Combined Thermostat and Push-Button.

In hotels, factories, or warehouses where it is desirable to have early indication of any dangerous rise in tempera-

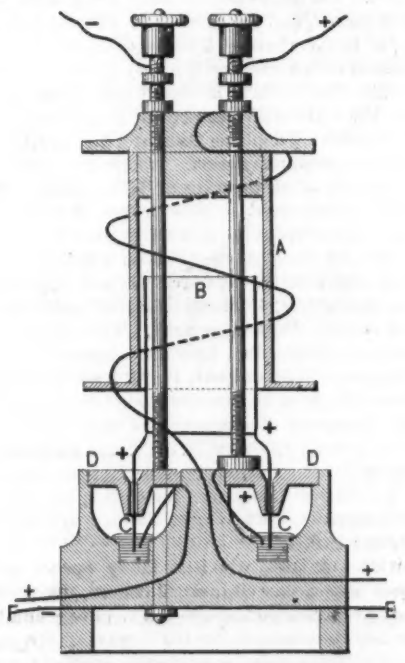
THERMOSTAT PUSH BUTTON.

ture, as in the case of fire, thermostats in connection with electrical indicators have come into extensive use. Recently an ingenious combination of the thermostat with the ordinary push-button has been devised by Messrs. Partrick & Carter, the well-known electrical apparatus manufacturers, of Philadelphia. This simple and effective little combination, shown in the illustration, is a regular push-button, but having inserted in the knob a disc of fusible metal, so arranged that when raised to a temperature of 110°, the disc softens, allowing the spring of the push to come into contact with an extension of the lower contact strip, thus closing circuit on any mechanism it may be connected to.

As the device, in the function of a push-button, is in constant use, a constant test of the line is effected, and where it is employed as a thermostat, the pressing of the button will indicate at any time the condition of the line.

A New Automatic Switch.

In ordinary incandescent lighting it is often desirable, and on the multiple series system it is even necessary, to provide means by which a fresh lamp is substituted upon the breaking of a filament in one of those burning. A novel automatic switch designed for this purpose is that shown in section in the accompanying illustration. It is the design of M. L. Clerc. It consists of a vertical sole-



NEW AUTOMATIC SWITCH.

noid *A* included in the circuit of the active lamp. Within the solenoid there plays a core or tubular plunger *B* of thin sheet-iron, which carries two rods *C* at its lower end, arranged so as to dip into two mercury troughs *D*. When the active lamp (connected at *E*) burns, the current passing in the solenoid raises the cylinder, and the circuit of the reserve lamp is open. Should an accident occur to the first lamp, the cylinder drops, the rods plunge into the troughs of mercury and the circuit of the reserve lamp connected at *F* is closed. The light is therefore interrupted only for an instant.

When the lamp is switched off in the regular way, the stoppage of the current allows the cylinder to fall. Thus, when the lamp in service is switched on again, the current for an instant passes through both lamps; but as the cylinder is almost instantly raised, the reserve lamp is cut out,

The mercury troughs are arranged so as to prevent spilling of the mercury, and have small conical openings at the top, to allow it to be conveniently poured in.

Since it requires power to keep the solenoid *A* energized, M. Clerc has sought to reduce that as much as possible by favorable construction, so that the electrical energy consumed in the solenoid does not exceed one watt.

If it is desired to have both lamps lit at the same time, this can be arranged by inserting an interrupter, which suppresses temporarily the function of the apparatus, and thus leaves both lamps in circuit.

A New Dry Battery.

BY I. L. ROBERTS.

It has been the effort of inventors ever since the first days of galvanic electricity to produce a dry battery. Volta attempted this, and supposed he had succeeded in constructing such a battery, but on further examination it was proved that there was sufficient moisture between the plates to cause the phenomenon observed, and the battery, therefore, was not strictly a dry battery. It is well understood at the present day that no galvanic action can take place without the presence of water. Anhydrous sulphuric acid will not attack zinc, but if even a small amount of water be added, action immediately begins, thus proving that water is necessary.

In the construction of my new dry battery no attempt

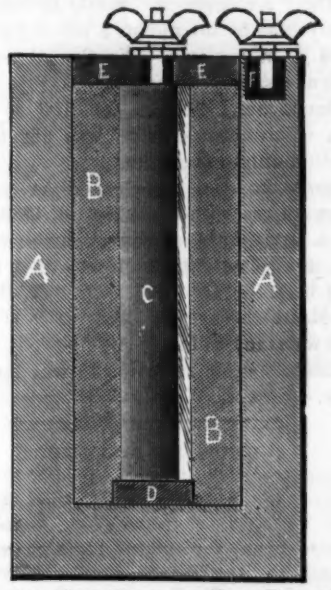


FIG. 2.—THE ROBERTS DRY BATTERY.

has been made, to claim that the battery is absolutely dry, but the electrolyte is a stiff paste made up by uniting two salts, both of which are in solution separately, but which produce a semi-solid when combined. They do not lose their power of attacking zinc or lose their conducting properties as does an ordinary crystal of any kind. For instance, a crystal of copper sulphate is not a conductor of electricity, although containing five atoms of water. Neither will a crystal allow chemical rotation of its atoms as does water. By taking advantage of these facts I have constructed a simple galvanic cell which is sent out from the factory fully charged with electricity, as it is popularly termed. These cells, the largest size of which is made 3× 6 in., have a capacity of about 20 ampère hours. However, not more than an ampère minute should be drawn out at once, as the battery is only fit for open-circuit work and will polarize.

The cell consists of a simple carbon cylinder having its cavity filled nearly to the top with the paste and a zinc pressed into it; the remaining space is then filled with asphaltum. Thus the cell is a complete article of commerce. Among the many desirable ends obtained is that there is an absence of fumes; the battery requires no attention, and no climbing of salts nor corrosion of connections takes place. It will be noticed that the carbon connection is made by the novel method of an expansive alloy, which, as a connection to a carbon, has no equal. The great advantage of the battery is that it can be shipped, handled and used without any fear of spilling liquids, and that the user is not required to do anything when he receives the battery, but connect the line wires. There is no preliminary filling operation liable to injure the clothes or surrounding furniture. The electromotive force of the cell is 1.7 volts.

The accompanying illustrations, Figs. 1 and 2, show an outside elevation and a vertical cross-section of a cell. The vertical section shows at *A* the carbon cell or cup, which while forming the cell proper, also serves as one of the elements. At *C* is shown the zinc element surrounded by the pasty mass *B*.

Beneath the zinc element is placed a piece of glass or other non-conductor *D*, to keep the zinc from coming into contact with the carbon *A*.

The upper part of the cell is closed by the asphalt cover *E*, which completely seals and closes the battery. The expansive alloy is shown at *F*.

For railroad cars, yachts, or indeed in any situation when the battery is liable to be shaken about and when ordinary batteries cannot be used, this cell is especially adapted. It will work upside down, sidewise or in any position. For

household use it presents many advantages, as no one, not even a child, can be poisoned by it, no injurious materials being accessible.

After the cells are exhausted they can be returned to the manufacturer, who can recharge them or furnish new batteries, allowing a suitable price for the returned cells.

The writer believes that this is the first successful attempt to construct a battery which can be handled, shipped and used, and in which there are no liquids to be added when the battery is set up or to be allowed for in the use of the cell.

The "Krotophone" as a Telephonic Receiver.

To the Editor of The Electrical World:

SIR: I looked over the patent No. 345,085, of July 6, 1886, upon its issuance and found nothing either startlingly novel, or startlingly peculiar therein, except its name.

The name "Krotophone" is, I should say, novel; although perhaps not specially useful.

Your notice of this patent, however, in the issue of THE ELECTRICAL WORLD of July 31, led me to take a second look at the said patent, with the idea that I had perhaps carelessly passed over some element of the invention which at once introduced novelty and usefulness.

I am unable to say that the second inspection disclosed any hidden grace. As a commercial telephone receiver I am afraid the "Krotophone" would be found wanting.

It is in any case by no means a new idea to employ the microphone as a receiver. Nearly all microphones are known also as contact receivers.

Mr. Berliner was, I believe, the first to recognize this property in microphones, as he was also the first to produce a microphonic transmitter.

The contact receiver he patented as early as Jan. 15, 1878; and again more in detail Nov. 2, 1880, the latter patent being a division of Berliner's historical microphone application for a patent which was filed as early as the summer of 1877. T. D. LOCKWOOD.

BOSTON, Mass.

[Mr. Lockwood is right as to the "novelty" of the device. What we called special attention to was the "theory" of its inventor.—EDS. E. W.]

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, August 9, 1886.

The Edison Company for Isolated Lighting is now snugly installed at 16 and 18 Broad street—the Cable Company's building. It occupies two floors. The first is set apart for offices. Mr. E. H. Johnson, the president, has a cozy room fitted up in admirable style. In a room adjoining is found Mr. F. S. Hastings, the secretary and treasurer. Near him are the book-keepers and accountants. The next floor is devoted to the department of engineering and general construction, all under the supervision of Mr. J. H. Vail. The whole place has a busy look, and the company appears to like its new quarters very well.

The new auxiliary Edison station, at 60 Liberty street, will have 4 dynamos of 500 lights capacity each. These machines will feed into the main down-town circuits. The increase of the company's business has been very marked of late, and it has been unable to meet orders for light for some time. The dynamos will be run by two New York Safety Steam Power Company's engines of 150 h. p. each, and the station will be adequately equipped with the best devices and instruments for efficient service. The plant will be under the control of Mr. C. E. Chinnock, the well-known local superintendent for the Edison system. It is of special significance, I think, that this enlargement of plant is made in spite of the late reduction of gas to $1.25 per 1,000, and it is only regarded as a stepping-stone to greater things to be carried out in a short time.

The Standard Underground Cable Company reports new contracts in Chicago, Pittsburgh and New York. The latest in New York is a second order from the Commercial Cable Company. It is for 14 conductors—Waring cable—extending from Nineteenth street south to Third street, in Second avenue. General Manager Ward of the Cable Company reported the tests of the cables laid under the first contract as showing about double the insulation required and called for. Mr. M. W. Hayward who had charge of the laying of the first cables will also lay the second lot. His experience in this line of business is large. Among the cables laid under his management for the company are those in Washington, Pittsburgh and Chicago.

The India Rubber and Gutta Percha Insulating Company, 159 Front street, New York, are making all kinds of insulated wires and cables, guaranteeing satisfaction. Among their orders is one for the Sims-Edison torpedoes, each cable being 11,000 feet in length, of seven strands of No. 23 copper wire covered with pure rubber insulation, protected with white rubber compound and taped. Around this are twenty No. 20 B. & S. copper wires insulated with pure rubber and protected as before, wound outside with two tapes, making a really splendid cable impervious to water. I was shown at the offices last week, a new idea in a 3-wire cable, each wire a core covered with a distinctively colored rubber compound. This is made specially for the Law telephone system, but is used also for the Johnson heat regulating apparatus of the National Electric Service Company. A similar 4-circuit cable was shown me, made for some special work. The company has a new insulating compound, which it claims to be water proof, as well as fire proof, to an extremely high degree of temperature, and which can be frozen at zero without cracking. A test of the wire was made up to 170 degrees Fahrenheit, when the insulation began to run; and when it was frozen at zero, it could be bent double without impairment.

The Consolidated Telephone Company (Shaver acoustic system) is placing one of its exchanges in Tiffin, O., and Mr. Shaver, the president of the company, has been there 3 weeks giving his personal attention to the details of installation. I hear that between 30 and 40 lines are already up, working to the satisfaction of the subscribers. The company has placed poles throughout the city and is running its wires on them. Personally, I should be very glad to see Mr. Shaver make other installations of this nature, for he has worked very hard in perfecting his system. I understand several orders await the completion of this.

The United States Electrical Company, 43 Wall street, New York, and 286 Fulton street, Brooklyn, is as active as ever producing small electrical specialties. I was very much pleased at seeing its new Carter electric light laryngoscope last week. It will reflect the light fourteen inches off, the size of a silver dollar. It is made to place between the eyes, resting over the bridge of the nose, and is held in position by a special frame. Many advantages are obviously gained by having the source of light so far removed, and one of the greatest is that instruments can be more freely used in working on the throat. The new sensophone or touch sounder, the principle of which has already been described in THE ELECTRICAL WORLD, is being tendered a hearty welcome among deaf mutes, in whose instruction it appears to be a marked boon. Yet another novelty is the electric cash-box for "bobtail" street cars. The use of this does away with oil-lamps in the cash-boxes. At night, when a passenger drops his fare in, a circuit is closed, ringing the indicator bell and illuminating a 2 or 4 c. p. incandescent lamp. In the daytime, the lamp can be switched out of circuit, leaving the bell to indicate when a fare is put in the box. If anything will make the life of a "bobtail" driver endurable, this will, and I think that street car managers for their own benefit will be likely to put this invention in every car they run.

Mr. Frank C. Mason, the energetic and capable superintendent of police telegraphs in Brooklyn, has been supervising lately the installation of a number of precinct boxes for telephonic police patrol. The sixteen "booths" have all been located in the First Precinct, and the police officers there are all thus brought into direct communication with his headquarters at regular intervals and on emergency. Next year, it is said, booths will be erected in four more districts. As the details of the system are familiar I need not enter into them. It will suffice to say that Mr. Mason has made a highly creditable piece of work of it in Brooklyn. It is high time New York had something similar.

Hawthorne & Frisbie, 12 Cortlandt street, the agents here for the Shipman engine, are now representing also the Mason speed governor for steam pumps, pressure regulator, steam trap and balanced valve. These goods, made by the Mason Regulator Company, of Boston, are in general demand, and will meet the necessities of many WORLD readers.

Paul F. Hoppe, 109 Liberty street, has some good steam pressure and vacuum gauges, revolution counters, steam engine indicators and like apparatus. He makes a specialty of pop safety valves and pyrometers, and has a serviceable control-clock for watchmen.

The Consolidated Electric Light Company has no summer dullness to complain of. On the contrary, Mr. Davis, the president, was almost deploring last week the fact that the company had more business than it could look after. He had detailed this man here, that man somewhere else; and he even felt like going off himself to see to new work awaiting attention in another place. Mr. Davis has in his office a sample of the triple globe lamp put in by his company in oil refineries and such places. It is a very ingenious and useful application. Mr. Davis has that craving for ubiquity noticeable in men of energy and push.

The Ball Electric Light Company of this city has issued a very pretty little pamphlet illustrative of the system it controls and operates. The lamps and dynamos are printed in red tint on the reading matter, and the cover is a tasteful blending, in gray and gold, of lamps, cherubs, dynamos and angels. As a whole, the production does Secretary Whitney great credit, and I would like to praise him for it if he would only let me do so. A long but partial list is given of users of the Ball system.

The Metropolitan Telephone Company does not find much slackness during the Summer season. It has now 6,020 subscribers, and the increase is at the rate of 100 a month. Just now the officers are resting—that is to say, Gen. Huidekoper is at Bar Harbor, Mr. Eckert is quite sick, Mr. Cahill is away West on a vacation, and Mr. Seely has gone off on a flying trip North. Mr. McNulty is busy with the details of the new underground work.

Chas. A. Schieren & Co. have been busy supplying "Electric" belting to electric light companies. They have recently filled orders for the Sunbury, Pa., Edison Company; Cumberland, Md., Edison Company; Williamsport, Pa., Edison Company; Houston, Tex., Electric Light & Power Company; Saratoga, N. Y., Electric Light Company (Indianapolis Jenney system); Arnoux-Hochhausen system, Paterson, N. J.; Brush Company, Lafayette, Ind.; Central Edison Station, Boston; Edison Company, Amsterdam, N. Y.; Edison Company, Lancaster, Pa.; Batavia, N. Y., Gas Light Company (Fort Wayne Jenney system); and several others to a less extent.

McLean Bros. & Rigg, who have lately opened an office at 52 and 54 New street, this city, are, I believe, the first Australian firm directly represented in New York. For a number of years they have had the contracts for the supply of electrical goods to the Postal and Telegraph Departments at Melbourne, Victoria; while their Sydney and Adelaide houses are both also interested in this class of goods, shipped to the respective governments of New South Wales and South Australia. Hitherto the articles required have been of Siemens' manufacture, and imported through the London branch. The firm have now opened yet another branch office here, as above, and hope to develop a trade in electrical goods of American manufacture in a general way.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., August 9, 1886.

The Telegraphers' Mutual and Literary Association of Boston gave an excursion yesterday to its members to Downer's Landing, near this city. The tickets had a large sale, many being purchased at the wharf. Many prominent telegraphers from all parts of New England were present.

The Gas and Electric Lighting Company of Waltham, Mass., has been incorporated. Mr. John R. Farnum has been elected president and Mr. Geo. A. Stearns treasurer. The capital stock is said to be $200,000.

The Harris-Corliss Engine Company, of Providence, R. I., is putting in the works of Messrs. A. & H. C. Knowlton, Gardiner, Me., a new engine of 100 horse-power.

The Providence Steam Engine Company has recently received orders for improved Greene engines as follows: Beswick & Kay, Philadelphia, Pa., 200 h. p.; R. B. Gage Manufacturing Company, Pawtucket, R. I., 200 h. p.; Glasgo Yarn Mills Company, Glasgo, Conn., 200 h. p.; Westerly Woolen Company, Westerly, R. I., 100 h. p.

Mr. J. H. Howard has resigned the position of treasurer of the Chemical Electric Light and Power Company, taking effect August 1. The multiplicity of Mr. Howard's interests in various electrical enterprises, all of which require a good deal of his personal attention, prompted him to take the step referred to.

The Electric Gas Lighting Company has just out of the printer's hands its new and profusely illustrated catalogue. The aim of the company is to place a copy in the hands of every dealer in electrical goods in this country and Canada.

The Wheeler Reflector Company, of this city, is supplying several of the leading electric light systems with attractive and useful glass reflectors for both arc and incandescent lamps.

The power of the central station of the Edison Electric and Illuminating Company in this city is to be increased at once from 300 to upwards of 2,000 horse-power. The Jarvis Engineering Company has the contract for furnishing the additional equipment, being Armington & Sims' engines, and boilers of improved pattern, set with the Jarvis furnace.

The American Tropical Telephone Company, with executive offices at 95 Milk street, Boston, is now making more energetic efforts than ever before to have its apparatus in every city and town, not already supplied, in South America, Central America and the West Indies. The price on instruments and apparatus has been reduced.

A three-story brick building 40 × 200 feet has been erected by the Electric Light and Patent Flooring Company, Amesbury, Mass., near the railroad. The first floor will be used for an engine room and for the business of Messrs. England and Jenkins, machinists, who have transferred their interests there from Merrimac. The Electric Light Company have in position a powerful engine, and are getting in readiness for supplying the town with light as soon as the contract can be obtained. To the manufacture of fancy mosaic floorings the company are adding that of hard wood house finish.

Mr. George J. Morse, of Boston, has been appointed special agent for the American Electric Company. Mr. Morse was the pioneer agent of the Fuller-Wood Company in New England, and during his connection with that enterprise he was successful in placing a large number of orders in this territory.

Messrs. Fuller & Holtzer, Boston, have recently increased the manufacturing facilities at their Brookline (Mass.) factory, and have added to their force of employés, both at the factory and in their city department. This firm is about to place in the market a large line of new electric gas-burners.

The Union Glass Company, of Boston, has for many years enjoyed a deserved popularity and large patronage among the parent electric lighting companies, and the local companies as well, owing to the excellence and durability of its arc-light globes. In this line the company manufactures globes of every desired size and shape; plain, half ground (vertically or horizontally), and wholly ground. Under the management of Mr. J. P. Gregory, whose connection with the company has been for more than a score of years, the Union Glass Company has attained an enviable position before the public, and it ranks second to no other glass company in the country.

The Jarvis Engineering Company reports business very good. It is now filling contracts in electrical work as follows: Rutland Electric Light Co., Rutland, Vt, complete steam plant; Nashua Electric Light Co., Nashua, N. H., complete steam plant; Manchester Gas and Electric Light Co., Manchester, N. H., complete steam plant; Weston Electric Light Co. (second order), Manchester, N. H., new boiler set with Jarvis furnace; New Haven Electric Light Co., 3 Armington & Sims engines (fourth order), 2 new boilers set with the Jarvis furnace; Natick Electric Light Co., Natick, Mass., complete steam plant; Edison Co., Boston, increase 1700 h. p. of engines and boilers; Charlestown Gas Co., Charlestown, Mass., complete plant; Edison Co., Rochester, N. Y., 3 Armington and Sims engines, 6 boilers set with Jarvis furnace; Brush Co., of Boston, 2 new Jarvis furnaces; Globe Publishing Co., 2 Armington & Sims engines; Massachusetts Hospital Ins. Co., 2 Armington & Sims engines; Malden Rubber Shoe Co., 1 Armington & Sims engine; Continental Clothing House, complete steam plant to run electric lights.

The Wainwright Manufacturing Company, 65 & 67 Oliver street, Boston, and 93 Liberty street, N. Y., manufacturers of feed-water heaters, expansion joints, radiators and corrugated tubing, have been forced, by their numerous orders, to enlarge their plant, and are erecting an addition to their factory of four stories, 31 × 78 ft., which will contain machine shop and corrugating and radiator departments. Their former building has been moved, and will also be utilized as a machine shop. By this change they will be enabled to increase their product some three or four times, and meet the demands of their rapidly growing business. The company report the following sales of their feed-water heaters during the month of July:—Ivers & Pond Piano Company, Cambridgeport, Mass., 80 h. p.; C. W. Lyman, Somerville, Mass., 100 h. p.; Thomson-Houston Electric Light Company, Northampton, Mass., 100 h. p.; Chadwick Lead Works, Boston, 150 h. p.; Morse Engineering Company, Kansas City, Mo., 2 heaters, aggregating 65 h. p.; Fairbanks & Co. Philadelphia, 60 h. p.; Knowles Steam Pump Company, N. Y., 60 h. p.; N. Y. Safety Steam Power Company, N. Y. City, 2 heaters, aggregating 160 h. p.; P. F. Collier, N. Y. City, 75 h. p. The Benedict & Burnham Manufacturing Company, Waterbury, Conn., have bought one of their corrugated tube expansion joints and they have shipped a large size filter to John R. Miller & Co., of Reading, Pa. They have also made large sales of their patent corrugated brass tube radiators throughout the New England States.

The Boston *Daily Globe* of July 31 contained an account of an interview alleged to have occurred between a reporter of that enterprising paper and a prominent electrician of this city, wherein the latter expresses the belief "that the use of under-

ground wires will become general." The *Globe* reporter quotes the electrician as follows: "I venture the opinion that nearly if not all of the telegraph and telephone wires in the city of Boston will be under ground within the next twelve months. There has been a great opposition to putting the wires beneath the surface of the streets in the past, but this is fast being overcome on account of the fact that the saving in the way of repairs will be large. Take the Western Union, for instance: The yearly receipts of that company are about $16,000,000, and about $5,000,000 are annually expended for repairs. I think it costs about $8 per mile to keep the lines in working order. With underground wires the annoyance and delay, as well as danger, will be avoided during electric storms. This, together with a large reduction in the cost of maintenance, is what recommends underground lines. Thunder-storms do not cause as much trouble as electrical disturbances, such as that experienced the other night when the northern lights, so called, were so brilliant. On that occasion, I am told, in the Western Union office on State street, Boston, the wires were grounded and despatches were easily sent to New York by the aid of the electricity in the air. There are a thousand different ways in which underground wires are superior to the present system, but I will not weary you with a recital of them, as I suppose you came here to have a quiet stroll on the sands, as I did." W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Aug. 7, 1886.

Interest in the electric light convention among people in this section is largely intensified by the fact that the association's next meeting is to be held in the West. The association had its inception, birth and first meeting in the West, and Western interest in its welfare and prosperity will always be genuine and lively, and Western electricians will always be among its staunchest advocates and firmest adherents. From what I can learn in my meanderings among the electricians of the West the attendance at Detroit by electricians and others from this section will be larger and greater than ever before. First, there will be the electric light men, wishing to pick up what may be learned in general, and to advance the merits and interests of their system in particular; then there will be the carbon men, who are not accustomed to remain in the shade by any means, especially when they know that their product is necessary to the production of the greatest of all lights—the electric; then there will be the engine men, who are certainly a "power," and we shall hear a great deal about "high speed," "low speed," and "automatic" engines. The friction clutch men will not be absent either, and it is always hard to give them the "slip," if there is an order in sight. The belting men will be on hand, and their talk will be "endless," and their pleas will be "riveted" and "cemented" by the most unanswerable of arguments. The oil-cup men will be present, and their speech will be smoother than the lubricants which their cups contain. The electric governor men will be in the vicinity, and if they are not able to "govern" to an extent that will bring them some handsome orders, my guess will be amiss. The line wire men will be there, and it is safe to say that their arguments will not be confined to a single "line," but will be "strung" out and extend over a considerable "circuit." The tower men will be present, and if they are "towered" over by others it will not be their fault. The converter men will be there, and will endeavor to "convert" their opportunities into hard cash. The indicator men will attend, and the indications are that they will not come back empty-handed. The professional and theoretical men will be there, and it is hoped that they will not profess to know more than the practical men, and that their theories will not dissolve into thin air. In fact, everybody will be there, and the meeting will be a rousing one.

The Secretary of State has issued licenses of incorporation to the following Chicago companies during the past week: The Combined Electric and Trip Bell-Cord Company, capital stock, $500,000; incorporators, William Glasgow, Samuel S. Stevens and Edwin S. Skinner. The Electric Illuminating Company, capital stock, $25,000; incorporators, William F. Dummer, Arthur D. Wheeler and William H. Finne. The Market Indicator Company, capital stock, $50,000; to manufacture and lease to Board of Trade men, etc., electrical indicators for giving the prices of wheat, etc.; incorporators, Edgar H. Kellogg, E. P. Whitford and D. C. Roberts. W. A. K.

THE TELEGRAPH.

Largest Earnings on Record.—A rumored movement to advance Western Union is accompanied by the oft-heard statement of the largest earnings on record. They came in July, according to report.

Not Less Than Half a Million.—We are told that the Bankers & Merchants' Company has been disposed to settle with Western Union for $500,000. The judgment of $240,000 was only for damages in the State of New York, and suits are being prepared in other States through which Bankers & Merchants' lines run, from which it is expected to obtain proportionate sums. Western Union, however, is declared not disposed to settle, but in favor of carrying the suits to the highest courts.—*Dow, Jones & Co.'s Circular.*

Western Business.—Cheap telegraphic rates east of Omaha have crowded the Western Union wires between that city and Chicago. This has led to the construction of two new lines of copper wire between Omaha and Chicago for the accommodation of California business, and principally for night press dispatches. The work began a few weeks ago, and it will be completed the coming fall. This will not cheapen the rates to California so far as is known, but it will secure a more speedy transmission of dispatches. The expense of copper wires for such a distance is great, but copper is preferable. Lines will be "multiplexed." The Western Union is continually building new lines and extending business. New lines are now building over the mountains. The work between Omaha and Chicago is the most extensive going on.

To Fight Western Union.—A special dispatch from Montreal of Aug. 6 says: Mr. George G. Ward, General Manager of the Mackay-Bennett Commercial Cable Company, is in the city, and has been in conference with Mr. C. H. Hosmer, General Manager of the Canadian Pacific telegraph lines, during the day in reference to the projected connections between the two systems. "We anticipate," said Mr. Ward to a reporter, "that this connection will be made within a couple of weeks at the most, and when the Canadian Pacific system is connected with the Postal Telegraph and the contemplated extensions are completed, the Western Union will have a competitor it may well be afraid of, which will dispute its monopoly at every important point on the continent." He also says that Mr. Mackay feels confident that the projected cable to Australia from British Columbia will be an accomplished fact within two years. The Canadian Pacific has also obtained control of the Canadian Mutual lines.

THE TELEPHONE.

Canadian Opposition.—A dispatch from Ottawa of Aug. 7 says: A new telephone company organized by local capitalists has begun service here in opposition to the Bell Company. The subscribers number fifty and the lines will be extended.

Missouri & Kansas.—The July report of the Missouri & Kansas Company shows progress. It says: "During the last three months we have built seventy-five (75) miles of extra-territorial lines, using No. 10 hard-drawn copper wire. The aërial cable capacity of our Kansas City Exchange has been increased from 1,600 to 2,200 subscribers, and switchboard capacity from 1,400 to 1,600 subscribers. Our expenses were increased $1,600 on account of the damage done our Kansas City Exchange by the cyclone of May 11. The net earnings for the first six (6) months of 1886 have been $46,560.15, while for the first six (6) months of 1885 they were $31,840.99, an increase of $14,719.16."

THE ELECTRIC LIGHT.

Amsterdam, N. Y., has its Edison plant about ready to go into operation.

Long Island.—Arc lights will soon be placed in Flushing. The Greenpoint Ferry Company has added to its lights on the water front.

Derby, Conn.—The Derby Gas Company is now using the Thomson-Houston system, and is supplying 45 divided arc lights. It has two dynamos.

North Attleboro, Mass.—The Electric Light Company, of North Attleboro, Mass., will extend its plant to Attleboro and Attleboro Falls.

Media, Pa.—The Media Electric Light, Heat and Power Company, of Media, Pa., has been incorporated. Capital stock, $10,000. Treasurer, Garrett E. Smedley, Morton.

Albany, N. Y.—The Edison Light and Power Company, of Albany, N. Y., has been incorporated. Capital stock, $10,000. W. K. Harcourt, D. Farlin, C. D. Hammond, G. W. Slingerland and E. Danforth, incorporators.

Malden, Mass.—The Malden Electric Light Company, of Saco, Me., has been incorporated with a capital stock of $30,000. President, Edwin H. Batchelder, Marshfield, Mass.; Treasurer, Albert C. Pond, Blackstone street, Boston, Mass.

Ballston, N. Y.—The Ballston Warren P. Freeman Illuminating Company, Ballston, N. Y., has been incorporated. Capital stock, $25,000. Messrs. Henry White, Martin Lee, James F. Peckham, Nath. Van Bell and Warren P. Freeman are the incorporators.

Long-Stroke Engines.—S. C. Randall, agent for the Schuyler Electric Light Company, who was in Leominster last week, reports the Boston *Journal of Commerce*, says there are no other steam engines built that give his company so good satisfaction as those manufactured by the Fitchburg Steam Engine Company.

Millville, N. J., is likely soon to have a Schuyler plant. The lights at Cape May have been examined by a committee of the City Councilmen, and the Council has now granted the Franklin Electric Light Company of Cape May an exclusive privilege in Millville for five years, during which period it will probably supply all the public lighting, both arc and incandescent.

The Detroit Meeting.—Mr. A. J. De Camp, Chairman of the Executive Committee of the National Electric Light Association, informs us that he has received a letter from Mr. W. H. Fitzgerald, of Detroit, Chairman of the Committee of Arrangements, stating that it would not be possible to secure a room suitable for convention purposes at any of the Detroit hotels, but that room could be had convenient to the Russell House, at which the "supply" members have secured quarters, and where, it is presumed, most of the members will stay. So far, it appears, no arrangement has been made for special rates. As to transportation rates, information up to date on that point is contained in Mr. Noonan's letter, printed in THE ELECTRICAL WORLD of July 31.

APPLICATIONS OF POWER.

Vicksburg, Miss.—The street railroad company of this city has it in contemplation to operate by electricity. It is tired of mules.

Philadelphia, Pa.—The local Brush company now has nearly 250 Stockwell motors running, with satisfaction to all concerned.

Baltimore, Md.—The Maryland Electric Motor Company, capital stock $250,000, has been organized in Baltimore to manufacture electric motors.

The Brill Car Company shipped two cars to the Daft Company's works Monday for the purpose of having motors attached, to be used at Los Angeles, Cal.

Pittsburgh, Pa.—The Allegheny Electric Light Company is introducing the electric motor into factories, etc., in Pittsburgh, and it is attracting great attention.

A General Demand.—The works of the Daft Company are rapidly turning out new motors for transmission of power to be used in Massachusetts, Rhode Island, Maryland, New York and elsewhere.

On the Clyde.—The falls on the Clyde, Scotland, are to be utilized in the production of electricity. Dynamos operated by turbines at Stonehouse will furnish electric power and light to the town of Lanark, a few miles away.

San Francisco, Cal.—The Brush Company has recently started up its new plant, and is now putting in a large number of Stockwell motors in industrial establishments, mostly to run sewing-machines. The demand promises to be very brisk.

An Important Step.—At a meeting of the directors of the Boston Metropolitan Street Railway on August 4, it was decided to adopt either electrical or cable motive power for the whole system, after due investigation. The company is tired of horses.

Ventilation.—Four Sprague motors are now running ventilators very satisfactorily in the Western Union operating room at "195," and it is proposed to put in a Sprague with ventilator at the Bijou Theatre, now one of the hottest places of amusement in this city.

Ryde Pier Electric Railway.—The directors of the Electric Railway Company of Ryde, England, have issued their report for the last six months. The working of the railway has given great satisfaction, and the financial result exceeds the anticipations of the promoters. This railway operates on the pier at Ryde, one of the longest in England, electricity having supplanted animal power.

Utilizing Water-Power.—The utilization of the water-powers occurring in many of the mining districts to drive hoisting engines, air compressors, pumps, stamps, etc., at the more or less distant mines is a long-dreamed-of economy, that appears to be upon the point of pretty general realization through the medium of electricity.—*Manufacturers' Gazette.*

Friendship, N. Y.—The local *Register*, one of the leading weeklies in Allegany County, N. Y., is to be printed by an electric motor made by the Enterprise Electric Company of Friendship. The company is turning out motors and electric light apparatus, and has erected a new factory building 40 × 80, with engine room 16 × 20.

Daft Locomotives at Baltimore.—The Daft motors on the Baltimore road have now been running one year, making an approximate mileage of 82,125 miles for three motors, figuring at the average rate of 75 miles per day, though four motors are often used, which virtually brings the mileage up to 100,000 for one year. One armature, No. 379, made the great mileage of 8,000 miles without any repairs or attention, save lubrication. This is a notable showing.

The Montgomery, Ala., Street Railway is working very nicely. The following little episode is reported by the local *Dispatch*: An old darky, speaking to a younger "ward of the nation" about electric street cars yesterday, said; "Hub, boy, you see how these white folks dun took away dem mules' job from 'em? Well, dat's de way dey is gwine to do de poor darky. Fust thing you know dey'll hab a plow what'll run rite along widout any nigger; and ef dey don't do dat dey'll get some kinder seed what'll grow widout any cultivation. Dese white folks is powerful smart, dey is."

PERSONALS.

Prof. A. G. Bell was one of the Americans recently honored with a degree by the University of Heidelberg during its recen celebration.

Mr. H. M. Byllesby, hitherto the Eastern agent for the Westinghouse Electric Company, has been appointed general manager for the system, with headquarters at Pittsburgh. More than a dozen solid sub-companies have already been formed, and Mr. Byllesby is one of the busiest men in a busy city.

Mr. E. Ingold, of Pittsburgh, who has been prominently connected with electric lighting interests there, has made a contract to represent the American Electric Manufacturing Company in Ohio and Kentucky. The company will, it is said, have the support of a syndicate with a cash capital of from $3,000,000 to $5,000,000, whose object is to put in combin d gas and electric light plants. The company is getting ready to occupy its new factory at New Haven, where it will have much more room than it has in its New York and Boston works. It is reported, too, that President Goff has obtained control of some new and valuable inventions.

Mr. Harrison Durkee, one of the oldest members of the Stock Exchange and a Vice-President of the Western Union Telegraph Company, died suddenly on August 4, at his home, No. 714 Fifth Avenue, of heart disease. He had been ailing for more than a year. He was born in Burlington, Vt., in 1812, and lived there until his fifteenth year. Then he moved to Troy and became in a few years the manager of the Howard Banking Institution. In 1836 Mr. Durkee came to live in New York. The following year he joined the Stock Exchange. It then numbered but fifty members and a seat cost less than $100. He was for many years a Director in the Erie Road and in the Western Union Telegraph Company. He retired from active business six years ago, leaving his affairs in the hands of his eldest son, A. W. Durkee.

Mr. Thos. A. Edison is reported to have gone into the shirt-making business. "You newspaper people," said Mr. Edison, in a recent interview, "think that I always must have just completed some wonderful invention which I ought to tell you about. Why don't you devour each other's fiction? An American correspondent wrote to a Berlin paper recently a tremendous story about my having invented a wonderful shirt of gelatine, made transparent by electrical treatment. This shirt was supposed to be built in layers of almost inconceivable thinness. Each layer was white and adhesive, and could be taken off when soiled; and as there were just 365 layers, and it was calculated that each sheet would last a day, a gelatine garment would last a year. Well, this marvelous tale went the rounds of the European press, and at last it was reprinted in Brazil. The gullibility of the South American may be appreciated when it is known that, soon after the shirt story met their eyes, the Brazilians began to send me drafts and checks for shirts. One idiotic diamond dealer," added Mr. Edison, mirthfully, "sent me a draft for £100 on the Bank of England. He wrote that he didn't know how much the shirts were, but he did not think they ought to cost over a hundred pounds apiece."

MISCELLANEOUS NOTES.

American Electrical Directory.—Bound copies of this directory for 1886-7, reviewed last week, are now in hand. The publication presents a very handsome appearance, and its usefulness renders it everywhere necessary.

Protected by American Torpedoes.—A dispatch from London says: Sebastopol and other Black Sea ports are now protected by an electric apparatus placed in the sea to destroy hostile torpedo boats. The construction of the apparatus, which is the work of American engineers, has been kept secret.

A Correction.—In our description of Mr. C. H. Pond's self-winding clock, in the issue of July 24, we referred to a test made of these clocks by the American Meteorological Society. It should have read that the test was made by parties in a manner and by such means as were approved of by an officer of that society.

A Nickel Lightning Rod.—Nickel is a metal which has properties similar to iron, but has the great advantage over the latter of not rusting in moist air. Iron is now used to a considerable extent for lightning rods; but inasmuch as it rusts in the air, nickel is preferable. A rod of nickel has been tried on a building at Dresden, but not for sufficiently long to test its durability. Everything, however, is in favor of the new material, and it will be interesting to hear how it serves, as copper is, apart from its conductivity, not a particularly good material for lightning rods.

A Blazing Meteor.—Report comes from Quebec that at Valcartier, on August 5, a blazing meteor, probably 10 feet in circumference, descended from the sky. "After touching the earth it assumed a strange appearance, creating terror in the minds of the country people, many of them conjuring up the worst fears, and looking forward to the speedy dissolution of the universe. Just previous to this occurrence the sky lowered, and the beasts of the field sent up distressing cries, bringing credulous persons readily to their knees in a supplicating posture." A few days before, the lightning had been very severe, and earthquake shocks had been frequent.

A New Battery Tester has been put on the market by the Standard Electrical Works of Cincinnati. It is only about three inches long and can easily be carried in the vest pocket. It consists of a small compass, with needle placed at right angles to the end of a helix of wire. In the helix is a loose iron core carrying a scale. When a current passes through the helix the needle is turned parallel to the core. As the core is withdrawn from the helix, the effect on the needle decreases until finally it ceases, when the needle returns to its position at right angles. If the core has no effect at all, the battery is at once shown to be very weak or worthless. There can be no question as to the demand for this cheap and effective appliance.

SPARKS AND FLASHES.

Galvanic Action.—"I see a medical journal says that toothache may frequently be cured by placing a silver coin on one side of the gum and a small piece of zinc on the other. It generates an electric current, you know, that stops the pain. By the way, Charlie, could you let me take a silver dollar till I try it on this tooth of mine?"

"Sorry, George, old boy; but the fact is, I haven't it in silver. Let you have a bill, though, old fellow, if that'll relieve your pain any."

"Thanks, awfully, dear boy, I think that'll help it some."—*Chicago News.*

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Western Union, b 67⅛, a 67⅛.

Telephone.—Am. Bell, b 204, a 205; Erie, b 27½, a 27¾; Mexican, b 1¼, a 1⅝; New England, b 39⅝, a 40.

Electric Light.—Edison, b 120, a 125.

BUSINESS NOTICES.

The Crockford Steam Generator made by the Crockford Steam Generator Company at 93 and 95 Mechanic street, Newark, provides, it is claimed, perfectly automatic circulation of water from the boiler and through the generator into the boiler again, preventing unequal expansion and contraction; keeping the boiler clean, and liberating steam more rapidly. It can be readily applied to boilers, and is at once cheap and durable. The Newark Electric Light Company says that the use of the generator has increased the capacity of the boilers there, for generating steam, about 25 per cent.

Chimneys.—The Jarvis Engineering Company, Boston, make a specialty of making plans and estimates on chimneys, and also erecting them. They build the cores of these chimneys larger at the top than at the base. This allows for friction and increases the draft 25 per cent. The area of the chimney should be equal to the combined area of the tubes in the boilers. This fact is seldom considered by masons or architects, who generally go by a rule of thumb. They have recently erected two chimneys for M. T. Stevens & Co., one at Haverhill and one at Franklin Falls, N. H. They have made estimates on a chimney for an electric light company in Boston; it will be 150 ft. high. The core will be 108 inches at base and 114 inches at top. The foundation of this chimney will be 15 ft. square, and it will require 285,000 bricks to erect it.

Westinghouse Engines.—The Westinghouse Machine Company, Pittsburgh, report sales of engines within ninety days, as follows: Trenton Electric Light and Power Company, four of 75 horse-power each; City of Mobile, two 60 and one 45 horse-power; Schuyler Electric Light Company, Wichita, Kan., two 60 horse-power; Ashland Lighting Company, Ashland, Wis., 45 horse-power; U. S. Electric Light and Power Company, two of 25 horse-power; Union Depot, Pittsburgh, Pa., two 75 horse-power; Fort William Henry Hotel, Lake George, 25 horse-power; Westinghouse Illuminating Company, of Schenectady, two of 75 horse-power; Keystone Electric Light Company, Philadelphia, Pa., three 75 horse-power; Allegheny County Light Company, Pittsburgh, Pa., two of 100 horse-power, being their ninth and tenth orders; Edison Electric Light Company, New Bedford, Mass., 125 horse-power; Plainfield Electric Light Company, Plainfield, N. J., two 150 horse-power and one 75 horse-power; Brush Electric Light Company, Buffalo, two 60 horse-power, being the sixteenth and seventeenth orders; besides a large number of single engines for isolated plants.

Hill's Hair and Whisker Dye
Colors to any natural shade of black or brown, 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure; 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

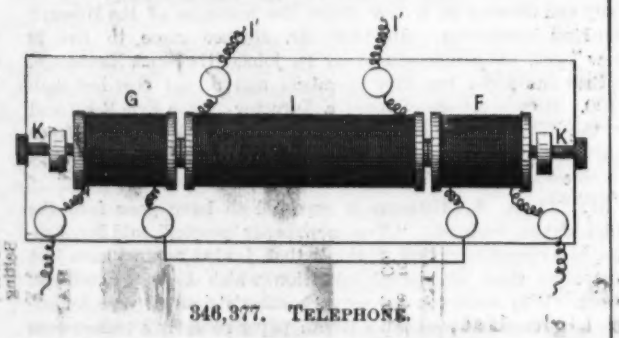
PATENTS DATED JULY 27, 1886.

346,094. Electric Clock Movement; Silas C. Dickenson, Wilton, Iowa. Consists of improvements upon his patent 334,517, Jan. 19, 1886.

346,183. Electrical Switch; Edward G. Waters and Robert G. Sweeny, Terre Haute, Ind. The object is to produce a switch by which one of several telegraph or other lines may be connected with a single instrument at pleasure. It is accomplished by connecting the several lines to a series of contact-springs which are arranged radially to a central hub carrying two points which are electrically connected with the two binding-posts of the instrument, each wire of the several lines being connected to one of said contact-springs, and the contact-springs connected to the incoming wires of each circuit being arranged to come in contact with a part or strip connected with the outgoing line-wire when not separated therefrom by the contact-points on the revolving hub.

346,207. Battery; William W. Le Grande, Louisville, Ky., Assignor of ½ to H. R. Dering, W. W. Dering and T. H. Upperman, all of same place. Consists of a positive electrode having a flat base and a central tubular receptacle projecting therefrom, a tubular negative electrode fixed in suspension to the top of the jar and extended partially within the tube of the positive electrode, an amalgamating element on the base about the tube and within it, and an acid solution.

346,214. Arc Lamp Clutch; Clarence B. Noble, Cleveland, O. Consists of a tube or cylinder, and containing within itself a loosely-fitting tilting friction-disc and wires for tilting and tripping the disc, to respectively tighten and loosen the grip of the disc against the interior of the carbon-holder for separating and feeding the carbons, the wires passing up through the holder and being connected, one with the lamp-frame, the other with the armature-core of the helix, the helix being in electric circuit with the lamp-carbons.



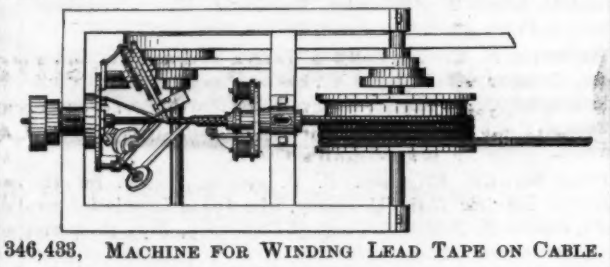
346,377. TELEPHONE.

346,215. Galvanic Belt for Body Wear; James H. Murray, Hopkins, Mo., Assignor to Dana A. Sargent, George D. Bowman and John H. Martin, all of same place. Consists of a series of metal plates which will produce an electric current when acted on by an exciting-liquid, said plates being placed in pairs and separated by a cotton or woolen fabric, the pairs of plates being connected in series, the ends of the chain formed by the connected plates being in electric communication with two body contact points.

346,250. Underground Conduit for Electric Wires; Frank Wheaton, New York, N. Y., Assignor to the Western Sub-Electric Conduit Co. The wires are passed from one cross slab to others successively, the said slabs containing deep grooves which make an angle to the general direction of the conduit.

346,258. Process of Electro-depositing Nickel; Edward C. Bates, Salem, Mass., Assignor to O. B. Morris, Moorestown, N. J. Consists first in depositing the nickel salts in water, adding cyanide of potassium, constantly stirring the same until a cream-like curd is formed, which afterwards becomes of a dark amber color; second, in adding ammonia thereto until of a light blue color; and third, in introducing the article to be plated and passing the current.

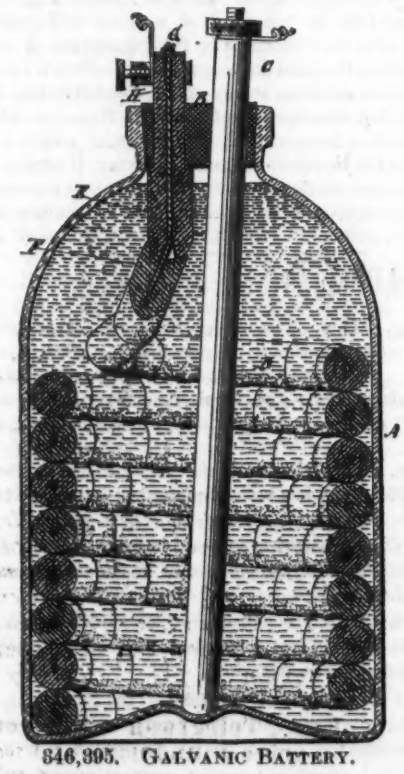
346,314. Electric Call; Edred A. Reeder, Dayton, O., Assignor, to George F. Griffith, of same place. Consists of a rod, connected with the escapement to vibrate therewith, a rotary rod and a brake, connected to the rotary rod to be moved by it to and from the vibrating rod to control the starting and stopping of the escapement and clock-train; the object being to provide means for setting the index of the call and allowing it to remain stationary until it is released for the purpose of sending



346,433. MACHINE FOR WINDING LEAD TAPE ON CABLE.

in a message at the option of the sender. This also enables the sender to set the device to any desired call, in which position it remains stationary until released. Thus the caller can send in the right signal with little danger of making a mistake. The mechanism which holds the indicator-hands stationary may be employed to readily check the sending in of a call, should the sender desire to correct it.

336,345. Incandescents; Clinton M. Ball, Troy, Assignor to the Vitrite and Luminoid Co., Watervliet, N. Y. Consists in subjecting a carbonaceous substance to the action of high



346,395. GALVANIC BATTERY.

heat in the presence of an organo-metallic vapor, or vapor of an organo-metallic compound, such as ethyl or methyl compound of aluminum associated with an oxidizing agent.

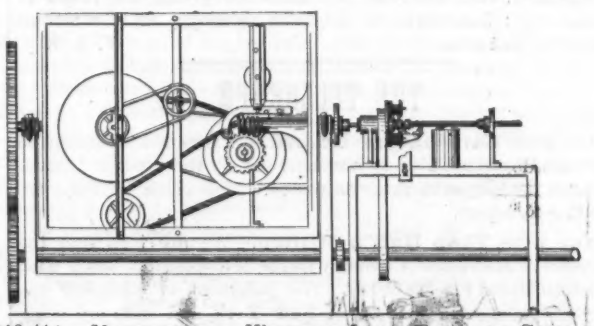
346,355. District Telegraph; John W. Chase, Grand Rapids, Mich., Assignor to Fred. A. Holcomb, same place. Consists of the following elements: The main circuit, including the subscriber's calling apparatus and electro-magnet answer-receiving apparatus and the main battery and call-receiving apparatus at the central station; the grounded normally-open sub-circuit at the central station, the supplemental generator and signal apparatus included in said sub-circuit, and switching mechanism for cutting out the main battery and connecting said sub-circuit to the main circuit; the object being to provide a telegraph system with "answer-back" devices, or means by which a calling subscriber may be notified when a call he has made has been properly received at the central office.

346,377. Telephone: William C. Lockwood, Hoboken, N. J., Assignor of half to Silas M. Stillwell, N. Y. As illustrated, it consists in providing a local circuit having the battery and transmitter in electrical circuit with two spools or helices properly arranged, and the line-wires leading to the receivers in circuit with a spool or helix located between the two spools or helices, the cores of the three spools, respectively, being separate, but arranged longitudinally in line with each other.

346,388. System of Lighting Railway Trains by Electricity; William A. Stern, Menlo Park, Assignor to himself and Thomas A. Edison, of Llewellyn Park, N. J. He claims substantially the combination with any system, of an auxiliary lamp which is automatically lighted upon the breaking up of a train.

346,395. Battery; Horatio J. Brewer, New York, N. Y. The negative element is in sections located upon a string and in contact with one another. See illustration.

346,414. Machine for Winding Lead Tape upon Telegraph Cables; William R. Patterson, Chicago, Ill., assignor to the Western Electric Co., same place. Relates to machines for covering telegraph cables, and its object is to provide means whereby any number of layers of lead tape, paper and yarn may be wound thereon, while paint and shellac may be applied to the lead tape as it is being wound on, so that the



346,414. MACHINE FOR WINDING LEAD TAPE ON CABLE.

joints thereof may be made tight. The construction is partly shown in the cut.

346,423. Electrical Connection and Guard; George D. Burton, New Ipswich, N. H. The essential feature is to interpose some non-conducting surface of such shape and size as to prevent the hands of the operator from accidentally being brought into contact with the electrified metal portions of the coupling.

346,430. Arc Lamp; Elisha B. Cutten, Pittsburgh, Pa., Assignor to the Electrical and Mechanical Developing Company, of same place. The thermo-expanding conductor employed is located in a derived circuit to the feeding mechanism.

346,433. Winding Lead Tape upon Telegraph Cables; Francis D. Duplain, Chicago, Ill., Assignor to the Western Electric Co., same place. The machine consists of a revolving head, a bobbin carrying the lead tape mounted thereon, a receptacle carrying the shellac, and a shellac-wheel, over which the lead tape is guided, whereby the lead tape is wound upon the cable and shellacked at the same time. The cut shows the disposition of parts.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.